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THE SURGICAL DISEASES

OF

CHILDREN

AND THEIR

TREATMENT BY MODERN METHODS

BY

D'ARCY POWER

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CONSULTING SURGEON TO THE CHILDREN'S HOSPITAL

IN

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This Work is Dedicated

BY

A FORMER PUPIL

THE AUTHOR.

βούλομαι, δ' ἄναξ, καλῶς
Δρῶν ἐξαμαρτεῖν μᾶλλον ἢ νικᾶν κακῶς.

PREFACE

LITTLE excuse appears to be needed for the present work. The surgery of childhood is singularly wanting in text-books. There are but a few in German, still fewer in French. In English, only the works of Mr. Holmes and Mr. Owen are devoted to pure surgery. Messrs. Ashby and Wright's excellent treatise, and Keating's Cyclopædia of the Diseases of Children, combine medicine with surgery.

Some excuse is perhaps necessary for the fact that the work is written by a single individual, and not by that system of collaboration which is now fashionable in medical literature. I believe, however, that the loss in detail is more than balanced by the gain in harmony, for conflicting statements are less likely to be made when a book is written by one person.

I have endeavoured to state briefly and yet clearly the various methods connected with the treatment of the surgical diseases of children, which have proved them-

selves the most successful in my hands. The work has been made as practical as possible, and only so much pathology has been introduced as is necessary to show why the modern treatment differs from that formerly employed. My position as a surgeon to the Victoria Hospital for Children, has given me ample opportunity of performing the more common operations; whilst as a teacher of operative surgery and tutor in surgery at the largest metropolitan school of medicine, I have been obliged to acquaint myself with the most recent surgical work both at home and abroad. The necessity of keeping the book within a reasonable compass has led to an apparent neglect of the orthopædic side of children's surgery. I have the less regret for this omission as there are already several excellent treatises upon this subject, and Mr. Walsham promises us a still more complete one, of which a part is to appear in the near future.

I have not hesitated to make very free use of the papers of Dr. Macewen, Mr. Howse, Mr. Clutton, Mr. Ballance, Dr. Brothers, Dr. Aldibert, Dr. Ryerson Fowler, Dr. Félizet and others, for these writers are past-masters in the subjects of which they treat, and my own limited experience is as nothing when compared with theirs. The collection of *Thèses* for the Paris M.D., which is being

augmented daily at the Library of the British Medical Association, has afforded me invaluable assistance, for each contains an excellent bibliography in addition to the original work which is often important. I have appended a list of papers chiefly remarkable for the excellence of the bibliography which they contain, or for their historical interest. It does not pretend to be more than a guide to those who wish to pursue each subject more thoroughly than can be done in a text-book, but to make it useful I have been at considerable trouble to verify my references, and so to adopt a rule which is more often honoured in the breach than in the observance.

It is my pleasant duty to thank most cordially those gentlemen who have kindly assisted me. My father and Mr. W. H. C. Staveley have done me good service in reading the proofs; Prof. Reid, Dr. Colcott Fox, Mr. Bryant, Mr. Jonathan Hutchinson, jun., Mr. Battle and Mr. Lockwood have lent me blocks, whilst the Staff of St. Bartholomew's and of the Westminster Hospitals have permitted me to make drawings of specimens in their museums. Dr. Sims Woodhead and Dr. Kanthack have been good enough to revise what I had written upon some of the more recent bacteriological work in connection with diphtheria and with actinomycosis. Dr. Lewis Jones has also laid

· an obligation by reading through the pages on
rolysis of nævi. I am further indebted · to Mr.
[essrs. Cassell, Messrs. Down, the publishers of
Anatomie and of Hoffa's *Lehrbuch*, for the
s with which they acceded to my request for
of the various figures which are borrowed from
orks. To each and all of these gentlemen I
y heartfelt thanks.

BLOOMSBURY SQUARE, W.C.
March, 1895.

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THE SURGICAL DISEASES OF CHILDREN

CHAPTER I

GENERAL SURGICAL CONSIDERATIONS

THE surgical diseases of childhood only need a special study in young children; for as the age of the patient increases, he comes more and more under the hand of the general surgeon. The children's surgeon requires some special qualifications if he is to be successful in the practice of his art. He must be rather more observant than the surgeon who deals chiefly with adults, for much can be learnt from an attentive study of the little patient, who is as yet unable to express his feelings or his symptoms. He must be very gentle in all his manipulations, for the tissues are but fragile and the sensations are very acute. He must be sympathetic, and must possess the power of winning a child's affections, and that quickly; for when such confidence is once obtained, the child will permit many liberties to be taken with it which would otherwise be impossible. Above all, the children's surgeon must be possessed of as keen an eye and as unerring a hand as a skilful operator for cataract, since most of his operations have to be done in a limited space and upon

the most delicate structures. In fine, the children's surgeon should be the antithesis of the late Poet Laureate's ideal, "big voice, big chest, big merciless hands."

There are a few points which render surgical practice amongst children different from that which obtains amongst adults. The difficulties of diagnosis are usually greater, for a young child is unable to localise its sensations or to give expression to its feelings, and more time has therefore to be spent in ascertaining the nature of a difficult case. A lack of observation or a want of care often leads to lamentable results: a fracture may be overlooked, the bellyache of spinal caries may be incorrectly interpreted, the pain and fever of acute infective osteomyelitis may be attributed to any but the right cause. Children, on the other hand, have less control over their feelings, and by their instinctive actions often give a clue to the nature of their illness. Too much attention can hardly be paid to the attitude of a sick child; his cry, his gestures, and often his very expression afford the most valuable information to those who can read them aright. The diagnosis of an injury is rendered more easy by the readiness with which a child can be stripped and examined from head to foot. Its difficulty is increased, on the other hand, by the fact that young children are often very fat, and that many of the bony points which are so useful in adults as landmarks are as yet undeveloped. It is almost superfluous to say that in examining a child the most superficial methods should first be employed, and then as the child's confidence is gained those which are more terrifying or painful. The exercise of a little discretion will often enable a careful surgeon to probe a wound or to examine the naso-pharynx without the use of any anæsthetic, and with comparatively little discomfort to the patient or to himself.

Rest and the conservation of parts are two golden rules in the treatment of the surgical diseases of childhood. Nowhere is the brilliant surgeon more completely out of place than in the operating theatre and wards of a hospital for children. The whole tendency of modern surgery is towards the performance of atypical rather than of formal operations, for the best results are obtained by putting the tissues in a position to cure themselves. Yet rest and the conservation of parts may do harm if carried to an extreme, as is too often seen in joint disease, in the treatment of tuberculous glands, and in insufficiently bold operations upon harelip. When an operation has been decided upon, it will generally be found that better results are obtained if the child be removed from its accustomed surroundings and is placed in the charge of those who have special experience in nursing sick children. Only in very exceptional cases can a mother be trusted to nurse her own child after a serious operation, and in many instances the recovery of a spoilt and fractious child is seriously retarded by the presence of those who love it best. It is therefore acting in the best interests of the child, to recommend that it should be placed a few days before a capital operation in a surgical home, or in the charge of an experienced children's nurse. It is also well to delay an operation of any magnitude, if it be possible, until the expiration of the incubation periods of the exanthemata from which the child has not yet suffered, and until it has recovered from its home-sickness.

Children as a rule bear general anæsthetics excellently for a short time, but they soon become collapsed, so that no operation should be unduly prolonged; and I do not remember to have seen a case in which it appeared to be inadvisable to give chloroform. Local anæsthetics are useless in young children. When chloroform has to be

care should be taken, in addition to the ordinary ıtions, that the child is not faint from hunger. It is ore a rule in my practice, when the operation is done e or ten in the morning, to order the patient to take l-sized teacupful of warm milk at seven o'clock. The form should not be given too quickly, for the child ɛries and makes such deep inspirations as to render it ılt to regulate the amount of vapour passing into the . It is perfectly possible, and it is often well, to ıister chloroform to a sleeping child; for many of the ɜr operations, such as squint and others in which no ngs are required, may thus be performed absolutely ut the knowledge of the patient.

ıldren bear hunger, cold, pain and loss of blood very , so that these are the main points to guard against ɛrating upon them. It has long been our custom at ictoria Hospital for Children to prevent loss of heat ants during the performance of an operation by plac- hem upon a water bed half filled with water at 100° ıd wrapping up all exposed parts in a thick layer of bent wool, kept in place by light bandages. After emoval of a child to its cot, hot water bottles or hot s will be sufficient to maintain its heat, the nurses ; warned against placing them in such a way as to the child to be burnt or blistered. Loss of blood ıg operations upon the limbs is usually prevented by ıpplication of an Esmarch's bandage; though there are cases, as in excision of the knee or elbow, where the equent oozing of blood prevents this method being of ice. It is most useful during the removal of sequestra, the cavity should be thoroughly packed with gauze re the tubing is relaxed. Hæmorrhage is arrested in r cases by the use of pressure forceps, which may be loyed with much greater freedom and certainty in

children than in adults, owing to the greater contractility of the arterial walls. Care must always be taken completely to arrest bleeding before the wound is closed. This is important, because operation wounds in children much more often heal by first intention than they do in adults, and it should be the endeavour of the surgeon to obtain so gratifying a result in every case, for when this is done the scars after a few years are as inconspicuous as those seen after a successful operation for the cure of a harelip.

Transfusion in cases of collapse from the loss of blood is often instrumental in saving a child's life. A saline solution is generally used, for the theory of its beneficial effect is that it acts by maintaining the blood-pressure, and so enabling the heart to beat under the least disadvantageous conditions until fresh blood can be produced, and in sufficient quantity to make up for that which was lost. Landerer says that salt solutions are useless in animals when the loss of blood exceeds $4\frac{1}{2}$ per cent. of the body weight. He employs a solution consisting of common salt ʒiss., white sugar ʒviss., dissolved in $1\frac{1}{2}$ pints of distilled water, to which one or two drops of caustic soda have been added. Krönecker's formula is somewhat simpler. It is $1\frac{1}{2}$ pints of water, to which 110 grains of common salt and 1 grain of sodium carbonate have been added. The solution in either case must be hardly alkaline, and it must be introduced at the temperature of the body. A teaspoonful of common salt in a pint of water is sufficiently near a 0·6 per cent. saline solution for ordinary purposes when, as usually happens, the operation of transfusion has to be hurriedly performed. The method recommended by Dr. Horrocks, as seen in fig. 1, is simple and effective. One of the veins at the bend of the elbow is exposed, and this is no easy operation

bloodless child. It may therefore be necessary to lay one of the venæ comites of the brachial artery, and to the canula into it instead of into one of the superficial s. The solution is allowed to flow into the proximal ion of the vein through a glass canula connected by

FIG. 1.—Diagram of Horrocks' method of transfusion.

ndia-rubber tube with a small glass funnel held three our inches above the arm. The india-rubber tube ld be provided with a clip to allow the air to be lled and the tube to be kept full of the saline solution. fluid is then allowed to flow into the vein until the e shows that a marked improvement has taken place in

the circulation. There need be no fear of introducing too large a quantity, but half a pint to a pint is generally sufficient. The canula is removed, the vein is ligatured, and the wound is closed and dressed in the ordinary manner.

Nearly all the forms of lower life flourish luxuriantly in and upon children, so that their convalescence after an operation is often retarded or arrested by one of the exanthemata. So prone are children to support microbic life that the vast number of surgical diseases are due to one or other of the protophytes which have effected a lodgment in their tissues or organs. They have the power of destroying many of these micro-organisms if their bodies be placed under favourable conditions, and even the most prolonged suppuration they often bear well and recover from. They should never, however, be left to fight for themselves in such cases, for the surgeon should make every endeavour to remove the cause of the suppuration as soon as possible. An effort, too, should always be made to abolish any pain from which a child may be suffering, for if this can be done he will often play and sleep as well as when he is in perfect health. Unlike adults, children look neither before nor after, they live for and in the hour, and so long as they are free from pain they are careless of slight inconveniences. Over and over again I have seen a child upon whom an hour before I had performed an osteotomy, or whose tendons I had divided, eating a hearty meal, and talking and laughing as if nothing had happened.

The indications given by the thermometer are of much less clinical value than in adults. A passing digestive disturbance, pain, sleeplessness, and such physical causes as terror or a fit of temper, are sufficient to raise a child's temperature in a manner which is appalling to those who

ot forewarned of its slight importance. Sudden and ient elevations of temperature are not unusual in of tuberculous arthritis in which the inflammation is ently local. We do not know the cause of these n feverish attacks, but they are of bad import and ossibly associated with dissemination of the disease, h for weeks afterwards there may be no evidence of eneralisation having taken place. A transient rise nperature may be, and usually is, of small diagnostic tance; but a permanent rise or a hectic temperature ie same value in children as in adults, and its cause l be as carefully ascertained and treated. A tem- ire which is only slightly above normal does not arily imply that everything is going on well after eration in a child, for extensive suppuration may be dent with quite a low body temperature; perhaps se, as the young tissues are more elastic, the tension marked, and there is less septic absorption.

treatment after operations in children is not usually led with any difficulty, for a sick child almost in- ively keeps a seriously injured part at rest. They sually very amenable to moral persuasion in less cases, and they are so conservative that when once ave been taught to lie still they will often continue so for an indefinite length of time.

ldren so frequently suffer from poisonous symptoms the use of carbolic solutions and of iodoform that I eased to use them for some time past, and I have ited myself with freshly boiled water to flush wounds incisions. I have also made use of camphorated naph- or packing cavities, and a solution of one and a half volumes per cent. in water of hydrogen peroxide ensing suppurating tracts. Camphorated naphthol, ed by Desesquelle of the Lariboisière Hospital in

Paris, is a colourless liquid, obtained by pounding separately one part by weight of β-naphthol and two parts by weight of camphor. The two powders are mixed, warmed gently and filtered. Camphorated naphthol is insoluble in water, but it is readily soluble in oil, alcohol, ether and chloroform. It must be used with some care, as poisonous symptoms have been produced by leaving an ounce and a half in a cavity. I have never seen any ill-effects follow the use of two to four drachms, but often great benefit. It produces a copious fluid discharge and the wound heals kindly, but the tendency for the discharge to dry renders it necessary to paint the margins of the wound with oil to prevent the sticking of the dressings.

Dressings of cyanide gauze, or of gauze which has been sterilised by heat without the addition of any antiseptic, are less irritating than the ordinary forms of medicated dressings, and are therefore better suited to the delicate skins of children. The dressings should always be as light as possible, and they should not be applied with too tight or too heavy a bandage. There is a little tendency to fall into these errors of bandaging owing to the absence of well-defined bony points in children, for the surgeon feels as if the bandage were insecurely applied. It is often very difficult in young children to keep the dressings clean and sweet when they are applied to the thighs and pelvis, and this forms a special difficulty in the treatment of hernia by the radical operation and in many cases of fracture and wounds of the thigh. It must be counteracted by the judicious application of waterproof over the dressings, by varnishing the plaster-of-Paris splints with ordinary spirit or finishing varnish, and by much extra vigilance upon the part of the nurse.

CHAPTER II

NON-INFECTIVE GANGRENE

Ætiology.—Non-infective gangrene is occasionally met with in children and, as in the adult, its cause is either local or general. The local causes are interference with the blood supply from pressure upon the vessels after fracture, the pressure being exerted by the ends of the bones themselves or by a badly applied bandage. It may occur as the result of a severe crush or compound fracture which has led to rupture or obliteration of the vessels or to injury of the large nerves. It occasionally follows too long an application of an Esmarch's bandage to the limbs of weakly children. Gangrene, due to constitutional causes, occurs in Raynaud's disease, sometimes in the later stages of typhoid fever, and in the diabetes of children about the age of puberty. It is especially liable to occur in the ill-nourished and in hospital practice, where even trivial wounds occurring in children from the lowest neighbourhoods frequently slough.

Pathology.—The pathological conditions are the same as in adults. The tissues die as a result of interference with the blood supply, and are cast off by a process of ulceration at the expense of the living tissues along a well-marked line of demarcation.

Symptoms.—The symptoms are more or less marked pain, œdema, alteration in the colour of the skin, variations

in the pulse, temperature and general condition of the patient.

Treatment.—The treatment varies with the particular form of gangrene, and is given in detail in the subsequent sections.

Traumatic Gangrene.

This is rare in children, but it is somewhat more frequent after fractures than after other injuries. It is characterised by the painless course which it runs. It is therefore advisable to see the patient frequently for the first few days after a splint has been applied, to enable the surgeon to assure himself that undue swelling is not leading to this calamity.

The gangrene which results from the prolonged application of an Esmarch's bandage is not often seen. It is preceded by an acute œdema of the part. The mortification is trivial and, as a rule, affects the edges of the wound. It is, however, an unpleasant complication, and its possible occurrence should be borne in mind when the surgeon undertakes prolonged operations upon bloodless limbs in delicate children who have a weak circulation.

Raynaud's Disease.

Ætiology.—Spontaneous gangrene of the extremities, which is either symmetrical or asymmetrical and which arises independently of obvious vascular obstruction, occasionally occurs in children, and somewhat more frequently in girls than in boys. The predisposing and exciting causes of the condition are quite unknown, but in a certain proportion of cases it seems to be associated with paroxysmal attacks of hæmoglobinuria and with peripheral neuritis. The severity of the affection varies greatly; in some cases it is merely a tendency of the

nities of the tips of the ears, of the nose, or of cer- ircumscribed cutaneous areas, to become numb and ess—the syncopic form—whenever the peripheral oles are contracted, either locally from the application d or reflexly by the dilation of the arterioles in other

More severe lesions are present in other instances; ctremities or other parts of the body become gangren- sometimes superficially, and sometimes the deeper is are involved as in the case (p. 13) related below. symmetry of the gangrenous patches is sometimes remarkable; but it is not an essential condition, for angrene is often unilateral. The gangrene is either dry or of the moist form.

mptoms.—The symptoms are often ill-defined, and atients are not seen until the gangrenous condition is established. The affected part becomes of a lilac r — the asphyxial form — and the patient complains ngling, which in a few days may become a severe

The tissues adjacent to the affected part are often le œdematous and hyperæmic. The heart is normal, he pulse never ceases to be perceptible in the arteries ie affected limbs, though it may be increased in ency and diminished in strength.

ogress.—The gangrene generally follows a continuous e, either acute or chronic, but the symptoms may be mittent. Dr. Raynaud states in his original thesis its duration is never less than twenty days, and never than ten months; but these two terms are excep- l, and the ordinary duration is three or four months.

ie **Diagnosis** is not difficult. The incipient gangrene be distinguished from chilblains and frostbite, whilst ain must not be mistaken for that due to rheumatism uralgia. It must also be distinguished from gangrene other causes.

The **Prognosis** is not wholly good, for although many children affected with symmetrical gangrene recover, a certain proportion die.

The **Treatment** in the earliest and simplest forms consists in stimulating the local circulation either by shampooing or by the use of the constant current. Dr. Barlow[1] states that he has obtained good results by plunging the extremity of the limb which is the subject of local asphyxia into a large basin containing salt and water: "Place one pole of a constant current battery on the upper part of the limb, and the other in the basin, thus converting the salt and water into an electrode. Employ as many elements as the patient can comfortably bear; make and break at frequent intervals so as to get repeated but moderate contractions of the limbs. In a typical paroxysmal case, if two limbs be similarly affected, it will be found that the limb which is subjected to the above treatment will more rapidly recover than the one which is simply kept warm." This method of treatment should be adopted both in the acute and in the chronic cases. During the painful periods an icebag may be applied to the part, or if this fails to give relief, warm applications may be tried. Amputation is required for æsthetic purposes when the gangrene has affected the deeper tissues of the fingers and toes; but it should not be adopted until there is a well-defined line of demarcation.

The following case which recently came under my care will serve to illustrate the general characters of the affection. A girl, aged 56 months, but looking much younger, was brought to me in March, 1893, suffering from gangrene of both feet. She had been much troubled in the winter of 1890 with chilblains, and in November, 1892, her feet and legs became livid in the evening, but were of the natural colour during the day. The toes became black and

shrivelled in December, 1892. The fingers had always been natural. The child had never walked or crawled, but there was no paralysis, and the want of power appeared to depend upon simple weakness. The father was subject to chilblains, but there was no family history of phthisis, diabetes, or heart disease. She occasionally passed large quantities of urine. The pulse, when I first saw the patient, was 144, regular and of high tension. The radial arteries were thickened, they were tortuous, and were more easily felt than usual. Pulsation could be detected in the dorsalis pedis artery of each foot, and in both posterior tibial arteries. The skin of the body was natural, the finger-nails were cracked and the finger-tips beneath the nails were blue. The heart and lungs were normal. The eyes were natural, and there was no retinal hæmorrhage. All the toes on both feet were shrivelled and black, and the gangrene extended to the metatarso-phalangeal joints. There was a small patch of black skin about half an inch in diameter on the inner side of the left heel, and at a corresponding point upon the right heel the skin appeared to be redder than natural. The patient was ordered a generous diet, with half an ounce of brandy every twenty-four hours. One-minim doses of tincture of opium with aromatic spirits of ammonia were given every three hours. A line of demarcation began to be formed five days after I first saw her, and nearly three months after the beginning of the mortification. The line of demarcation was formed along each series of metatarso-phalangeal joints, and at the same time the slough on the left heel separated, leaving a small superficial ulcer, whilst the red patch on the right heel completely disappeared. Four days later, on March 18th, the phalanges of the little toe on the left foot were completely separated. Chloroform was administered on April 6th, and the remaining phalanges on both feet were removed.

The patient made an uninterruptedly good recovery, except that on April 16th a small black spot was noticed about the junction of the upper with the middle third of the anterior surface of the right tibia. The child was again ordered to take one-minim doses of laudanum, and the spot disappeared in a few days. The urine was repeatedly tested whilst she was under treatment. It was generally neutral or feebly alkaline, and it was at all times free from sugar, blood and hæmoglobin. It contained crystals of triple phosphate, and on one occasion there was a trace of albumin. A year later, the child was fat and well. She had passed through the winter without any return of her old symptoms.

Typhoidal Gangrene.

My friend and colleague, Dr. Dawtrey Drewitt,[2] * has recently published a short but complete account of gangrene of the limbs following typhoid fever. He thinks that gangrene in this disease is more frequent in children than in adults, because the young heart is able to hold out to the end in cases of typhoid, where older hearts would fail, and though grey and bloodless are still able to contract on the half dried up and clotting blood-stream. The facts, that in typhoid fever the gangrene occurs late in the disease, and is generally preceded by a sudden pain in the limb, whilst the artery becomes big with thrombus, points, Dr. Drewitt considers, to an embolic origin. He therefore recommends that cardiac stimulants as well as an abundance of fluid food should be given in the later stages of typhoid fever to counteract any tendency to the formation of emboli.

* The Nos. throughout refer to the Bibliographical Appendix.

CHAPTER III

ON-TUBERCULOUS INFECTIVE DISEASES

SAPRÆMIA.

e simplest form of septic disease is that which arises n a suppurating wound. The child is constipated, temperature rises two or three degrees, he is flushed, wsy, and has a bad appetite. The neighbouring lym-ıtic glands become tender, enlarged, and may suppurate. e vent is to be given to the pus if it has been confined. e wound should be well cleansed and dressed antisepti-ly, the bowels are to be relieved, and in a day or two signs of the fever will have disappeared.

SEPTICÆMIA.

More serious manifestations sometimes present them-ves after an operation. Symptoms of a typhoidal ıracter arise, and the child passes through an attack true septicæmia, often associated with a rash. This h is an erythema of infective origin, and is often seen ound the seat of puncture after the inoculation of the ious antitoxins. It is not uncommon during convа-cence from diphtheria and typhoid fever. It appears ıt near the joints or upon the buttocks, somewhat less quently upon the belly, and still more rarely on the ck. The rash varies considerably in extent, it is fugi-e, and has a great tendency to become petechial. It often symmetrical, but it does not spread. Its appear-ce is attended by constitutional symptoms of greater or s severity. The temperature rises, falls, and rises again, e pulse-rate is increased, the patient vomits, and has

diarrhœa. The urine is scanty, and may contain albumin. These symptoms are truly septicæmic. There is no doubt that they are caused by an inflammation which is secondary to the disease from which the child is convalescent, and that they are due to septic organisms lurking in the various mucous membranes of the body. The attack may be complicated by pneumonia, bronchitis, or pericarditis. It does not usually cause death in an uncomplicated form.

The **Treatment** consists in removing the local cause of infection as soon as possible, clearing out the contents of the bowels with Rochelle salts or a calomel purge, and, if necessary, rendering the alimentary tract aseptic by the administration of small doses of β-naphthol. Quinine should be given, with brandy and plenty of milk. The prophylactic treatment is to render the mouth and pharynx aseptic during convalescence from pneumonia, diphtheria, typhoid fever and other diseases which are likely to lead to the harbouring of micrococci. This can be done by the use of gargles, sprays and tooth brushes.

PYÆMIA.

Ætiology. — Pyæmia is one of the worst forms of septic disease, but like septicæmia it is not very common in children. It is met with in new-born infants, associated with a similar puerperal condition in the mother, or the child may become affected independently from its filthy surroundings. Pyæmia in older children is perhaps most often associated with neglected osteomyelitis, with mastoid abscess, causing purulent infection of the lateral sinus, or as a sequel of diphtheria and erysipelas. I have seen it follow excision of joints and compound comminuted fractures, when children have been run over by tramcars.

Symptoms.—The pyæmic symptoms are the same as

› met with in adults. Extreme prostration, irregular erature, repeated rigors, sweating, and greatly en-ed cardiac action are the chief points. The abscesses l in the joints are not necessarily accompanied by ased febrile disturbance at the time they are formed, gh a fresh abscess is often found within a few hours rigor.

›urse.—Pyæmia in children runs a rapid and fatal ›e, characterised by the formation of abscesses in dif-t parts, and frequently by gangrene of the skin. It ronic in a few cases, and may then cause secondary cations of one or many joints, as a result of the sup-tive arthritis which characterises the disease.

'eatment.—The only treatment consists in the free nistration of quinine and stimulants, the early opening ›condary abscesses, and the thorough cleansing of any ıd. Ligature of the vein carrying blood away from ıffected part is sometimes of service; but this treat-: is considered in greater detail under the heading of tive thrombosis of the lateral sinus.

ERYSIPELAS.

tiology.—Erysipelas occurs even in new-born chil-for in Lebedeff's case the streptococcus erysipelatosus found in the skin of a child who died ten minutes its birth from a mother who was herself suffering erysipelas. It most commonly attacks the navel genital organs, though it may also start from abra-, ulcers and eczematous conditions of skin in other ı. It is not very uncommon after vaccination, or chickenpox. Young children are especially liable tack, and they bear erysipelas badly, for they often apidly with diarrhœa and bronchitis, or if they 'er from the immediate effects they succumb to the

inflammatory and gangrenous conditions of the skin which form such common sequelæ. Indeed, it is said that children under one year old who are attacked by erysipelas, die, and yet they only suffer from the cutaneous form. Erysipelas is very rare in older children, and they usually bear it much better.

The **Symptoms** are the same as in adults. There is a well-marked initial rigor, with vomiting, delirium, increase of temperature to 104–105° F., and erratic erythema with the formation of bullæ.

Treatment.—The treatment consists in the administration of half-drachm doses of Epsom salts, and as soon as the bowels have been well opened, a mixture containing tinct. ferri perchlor. ℥xx. and glycerine ʒ i. in each ounce of water should be given three times a day for a child of six to eight years. Alcohol, best given in the form of brandy or whisky, is nearly always required as a stimulant. The inflamed part should be dressed with lead lotion, or it may be powdered with oxide of zinc.

CELLULITIS.

Ætiology.—Acute cellulitis is rare in children, but the more chronic forms associated with infective disease are by no means uncommon. They are usually associated with diphtheria, for the relief of which tracheotomy has been performed, leading to cellulitis of the neck and septic osteomyelitis, causing cellulitis of the limbs; but cellulitis may also occur in the course of an attack of chickenpox, scarlet fever, or measles.

Symptoms.—Primary cellulitis is an acute inflammation, and runs a very virulent course. It attacks the submaxillary or, more rarely, the ischio-rectal region in children who have been weakened by some debilitating disease, or who from some other cause are in a bad state of

health. In the submaxillary form the lymphatic glands at the angle of the jaw become enlarged, but they do not suppurate, and a brawny œdema very soon affects the neck, from the chin to the sternum, either on one or both sides. The mouth and pharynx often remain unaffected, but the tongue may become swollen, owing, Mr. R. W. Parker[3] thinks, to the pressure of inflammatory products upon the lingual vein. The disease reaches its height in two or three days, and is characterised by the usual symptoms of septic infection, rendered more acute by the fact that the inflammatory products are pent up under a very dense fascia. There is a difficulty in swallowing in some cases, but in many dysphagia is by no means a prominent sign. An abscess forms when no treatment is employed, and it opens either by the side of the tongue, or externally at the margin of the jaw. The patients recover in a few cases, but in too many instances they die of septicæmia, and in a very short time. A similar condition occurs in adults, and was first clearly described by Dr. Ludwig, of Stuttgart (*Medicinisches Correspondenz-blatt*, Bd. 6, 1836, p. 21), after whom it has received its modern name of Angīna Ludovici.[3] It was, however, known to Aretæus and to Paulus Ægineta, for both writers describe it.

The **Treatment** consists in early and free incisions carried through the deep fascia, and with as little loss of blood as possible. The incisions should be made before gangrene of the cellular tissue has occurred, and when only blood-stained serum exudes. Some effective means of drainage must be adopted, and wounds must be dressed antiseptically. It is then probable that the disease will run a simple suppurative course. Quinine, brandy, and a sufficient supply of easily digested food are imperatively demanded.

FURUNCULOSIS.

This is a very common disease in the badly nourished children of large towns. The boils appear in crops upon the trunk more often than upon the extremities, and they are often so close together as to lead to a diffuse suppuration. They may be so numerous and are accompanied by so much constitutional disturbance as to put the life of the patient in jeopardy.

The **Treatment** consists in feeding the child well and regularly, and administering ¼-grain doses of calcium iodide or sulphide three times a day. Yeast, too, in doses of one or two teaspoonfuls three times a day, may also be used with advantage in some cases. It is given quite empirically, for we have no idea of the manner in which it acts. Poultices should not be applied to the abscesses, but the skin over them should be carefully and gently washed with soap and water; and it should then be incised, and dressed with gauze soaked in a 40 per cent. solution of carbolic acid or a 1 in 2000 solution of perchloride mercury.

PHAGEDÆNA AND SEPTIC GANGRENE.

Dr. Gee explains phagedæna to be a rapid ulceration, the tissues being destroyed particle by particle, and being cast off in like manner. In gangrene the dead tissues remain *in situ* until the patient dies, or are cast off in masses called sloughs. This distinction is a real one, and is of practical value. Both phagedæna and gangrene occur amongst children, and their cause is either local or constitutional. The best known form of phagedæna is noma, including cancrum oris, though it occasionally assumes a gangrenous form.

Noma and *cancrum oris* occur in children, between the ages of three and six years, who have been weakened by an attack of scarlet fever, measles, typhoid, or less frequently,

in the very debilitated without any such predisposing cause. As the terms are used in this country, noma is usually restricted to an acute inflammatory condition, rapidly passing into phagedæna, and affecting the vulva or penis, and more rarely the anus, whilst cancrum oris is a similar condition affecting the mouth. There is no reason, however, why noma should not be used to the exclusion of cancrum oris.

Course.—The affection begins insidiously on the mucous surface of the part attacked, the skin remaining white. The deeper tissues soon become infiltrated, and a small, hard and round spot can be detected. Examination of the mucous membrane will reveal a painless patch, covered with a yellow secretion. This patch rapidly spreads, and the whole of the infiltrated tissues are destroyed. The disease, as we see it in London, runs an acute—gangrenous—and a less acute—phagedænic—course, the slower form being the more usual. I have only seen it amongst the poorest and most neglected children.

Treatment.—The course of the disease must be arrested, if possible, or death will take place in eight to twenty-one days from pneumonia, bleeding, or starvation. The readiest means of stopping the inflammatory process is to put the patient under chloroform, scrape away the foul and softened area, and then thoroughly swab it over with fuming nitric acid, or acid nitrate of mercury, taking care that none of the caustic passes beyond the diseased tissue, and that all excess is wiped away. Very great deformity sometimes results from the destruction of the tissues if the patient recovers, but in the acute cases all remedies are too often useless. Fresh air, good food, alcohol, small doses of opium, and local applications of chlorate of potash, will assist the patient's convalescence as soon as the sloughing process is arrested. The affection is no doubt due to

micro-organisms, but no specific form has yet been isolated.

GANGRENE OF THE FAUCES AND SOFT PALATE.

This may be erysipelatous, but it is sometimes idiopathic, and it then occurs as an insidious and very fatal form of disease in young adults.

Symptoms.—It commences as an acute inflammation of the tonsils, with the ordinary symptoms of pain, fever, dysphagia, and constipation. The inflammation rapidly passes on to gangrene, involving the soft palate and the fauces, leading to the formation of an extensive slough. The symptoms are not unduly severe, and there is but little pain, so that the surgeon is apt to be thrown off his guard, until the stinking discharge and a sharp hæmorrhage from the mouth or nose warn him of the true nature of the case.

Treatment.—The few cases I have seen have run a rapid and fatal course, in spite of all that could be done for them. The condition must be distinguished from an allied form of phagedænic ulceration of the fauces, which is not uncommon after the exanthemata, and notably after scarlet fever, diphtheria, and typhoid. This secondary form is less likely to kill, for it is amenable to treatment internally by quinine and tonics, locally by chlorate of potash spray. The anterior pillars of the fauces are found after recovery to be perforated, the perforations sometimes being single and sometimes double.

GANGRENOUS EMPHYSEMA.

Pathology.—Malignant œdema is a very severe form of gangrenous inflammation produced by the inoculation of a bacillus capable of spontaneous movement. It is smaller than the anthrax bacillus and, during sporulation, it en-

s at one end and forms an oval, brilliant and bluish . It is essentially an anaërobic organism, and it in the earth, only occasionally migrating to animal es.

tiology.—The disease is due to the direct inoculation ie bacillus into the cellular tissue of the body.

mptoms.—The incubation period is from a few hours x days after a more or less severe injury, marked by *ise*, and often associated with pain around the wound, sometimes with so much bronzing of the skin as to Velpeau to give it the name of *erysipèle bronzé*. Dr. well Park, in his recent Mutter Lectures, says that invasion period is characterised by a rapid elevation of perature which continues with but trifling remissions l death. The tongue becomes dry and covered with a k and foul fur. The patient soon loses consciousness comes apathetic, complaining only of pain and burning st. Incontinence of urine and fæces, frequent and rficial breathing, and dilatation of the pupil are the ursors of death, which may occur from fifteen to thirty s after the onset of the acute symptoms.

he inflammation spreads rapidly from the wound, and s to a speedy destruction of the tissues with the forma- of gas. A dirty, reddish-brown skin, mottled with , whose veins are filled with stagnant blood, covers affected areas. The underlying tissues are sodden with l, and distended with the gaseous products of decom- tion. They yield a fine crepitus, due to subcutaneous hysema. A thin and foul-smelling secretion flows from wound.

Diagnosis.—Gangrenous emphysema is not always ignant œdema. It might be mistaken for quarter-evil, a closely similar condition has been met with after oid fever.

Prognosis.—The prognosis is serious, but not necessarily fatal.

Treatment.—The treatment consists in making free incisions, with as little loss of blood as possible, and the most thorough disinfection of the wounds. The strength of the patient must be supported by every possible means.

ACUTE RETRO-PHARYNGEAL ABSCESS.

Ætiology.—Retro-pharyngeal abscess,[4] due to inflammation of the deeply seated lymphatic glands in the neck, which receive the lymphatics of the tonsil, soft palate and pharynx, is not very infrequent in children. It often occurs insidiously and from no very apparent cause, though a cross-examination of the parents may elicit a history of otitis, nasal catarrh, teething, or other chronic inflammation of the tissues near the pharynx. The abscess is associated with the presence of several forms of streptococcus usually found in the larynx. It is due in other cases to the burrowing of an abscess in the neck from inflammation of the middle ear, or more rarely to scarlet fever, measles, or direct injury. A more chronic and otherwise widely different form is secondary to tuberculous or other disease of the cervical vertebræ (p. 81), when the pus accumulates beneath the deep fascia and the anterior common ligament; whereas in the acute cases it is situated in the cellular tissue, between the pharynx and the fascia covering the prevertebral muscles.

Symptoms.—The onset of the disease is singularly insidious; the child is obviously ill, but there is nothing to account for it until, as the pharyngeal swelling increases, deglutition and respiration become impaired. The voice is said to be low and quacking like a duck; but this was not noticeable in any of my cases. The child usually keeps

ead in a fixed position, either bent towards the un-
ed side when the abscess is unilateral, or inclined
ırds when the swelling is median or bilateral.

agnosis.—The diagnosis is readily made by an exam-
ɔn of the inside of the mouth, when a swelling usually
d to one side of the middle line will be seen bulging
harynx forwards. The swelling feels soft, fluctuation
ɐ obtained, and its upward and downward limits are
r felt, though in some cases it may pouch downwards
a psoas abscess (fig. 14), one pouch being connected
another by a narrow channel. When the collection
ıs is considerable it may point in the neck, pushing
arge vessels in front of it, and giving rise to a pulsat-
:umour which might conceivably be mistaken for an
rism. The urgent dyspnœa often accompanying these
:sses makes it necessary to distinguish them from
), bronchitis and œdema of the glottis. Simple exami-
ɪn of the throat will establish the presence of an
:ss, whilst even slight external pressure upon the
ıx markedly increases the dyspnœa and the pain. The
) is less affected than in croup or diphtheria.

ɔurse.—The duration of the disease is from two to four
:s, though it sometimes runs an acute course and opens
taneously, or it may become chronic, as in cases of
ical caries, when it may extend downwards into the
astinum or pleural cavity; but the abscess should
r be allowed to open itself, as it has been known to
e instant death by discharging its contents into the air-
ages during sleep, or from hæmorrhage by ulcerating
the large blood-vessels of the neck. Broncho-pneu-
:a and œdema of the glottis are the most frequent
)lications in ordinary cases.

reatment.—The treatment consists in opening the
ɜss through the neck, either by Chiene's incision along

the posterior border of the sterno-mastoid, or by Burckhardt's incision along the anterior border of the muscle. I prefer the former method. A one-inch incision is commenced an inch below the mastoid process and immediately behind the posterior border of the sterno-mastoid. The knife is laid aside as soon as the deep fascia has been divided, and the abscess is opened with a blunt-pointed director, one finger being kept in the mouth touching the back wall of the pharynx. The abscess is readily emptied by pressure exercised through the pharynx; but care must be taken to empty any pouches which may extend downwards. The proof of having done this successfully is the marked improvement taking place in the respiration. The abscess cavity is well washed out and a drainage-tube is inserted,—for I have not yet ventured to scrape and try to obtain union by first intention,—the ordinary dressings are applied, and the child in uncomplicated cases usually does well. It sometimes happens that the dyspnœa is so urgent that it is necessary to perform tracheotomy, and when this is requisite, the low operation is said to be preferable to the high. The after-treatment consists in keeping the child in bed with its head fixed until the wound has healed, and in giving plenty of good food.

The older operation of opening the abscess, by an incision carried through its whole extent in the pharynx, would not, I think, give such satisfactory results, though it is still recommended by some surgeons, as the bleeding and the discharge of pus in a patient whose respiration is already greatly impeded, renders it dangerous, quite apart from the fact that after such an operation the abscess cannot be kept aseptic. It is possible, however, that cases might arise in which such a method of opening would be more advisable than that of incising through the neck. Aspiration in these cases should not be attempted.

ACTINOMYCOSIS.

Ætiology.—Actinomycosis is a rare disease sometimes affecting children, for I saw Dr. Douglas Powell's [5] patient, a boy of nine. It is due to the invasion of the tissues by a fungus, sometimes derived by inoculation from cattle, but more often perhaps from infected grain. The exact method of introduction is doubtful, but it probably gains entrance by the respiratory passages, and in a few rare instances by the mouth, through carious teeth.

Pathology.—The actinomyces fungus has a characteristic appearance which allies it to streptothrix. It consists of a mycelium associated with a considerable quantity of inflammatory granulation tissue. The mycelium is surrounded by a fringe of clubs arranged radially, which has led to its name of "ray fungus." Only the most typical specimens terminate in these clubs or cocci, whose significance is still unknown. The younger nodules in man rarely show the club-shaped extremities, whilst the older nodules often lose their central mycelial mass and become crescentic in shape. The growth spreads by continuity from tissue to tissue, it sets up local irritation, leads to extensive suppuration, and may cause pyæmic symptoms.

Symptoms.—The symptoms are those of a chronic abscess affecting the skin, mucous membranes, bones or viscera, especially the lungs and liver. It appears on the skin in the form of numerous globular masses which are soft and spongy and have an indurated erythematous base. Dr. Pringle's case, occurring in a boy of thirteen years, presented large, sarcomatous-looking growths, ulcerating at various points, situated upon hard, brown and deeply undermined skin. From the ulcerating points pus exuded, mixed with characteristic yellow granules which were recognised under the microscope as colonies of actinomyces.

Diagnosis.—It is found that the abscess either consists of caseating substance, or of a semi-fluid, brain-like material mixed with blood. It is therefore most likely to be mistaken for a chronic tuberculous abscess, for a sarcoma, or for an empyema. The pus, however, is gritty, and close examination reveals that the grittiness is due to minute nodules just visible to the naked eye and readily seen as rounded masses under a low power of the microscope, consisting of colonies of the ray fungus. In cases of suspected actinomycosis, Gram's method of staining, applied to a coverglass preparation of the colonies obtained from the pus, will easily demonstrate the typical masses of branching mycelium. The clubs may be shown, if they are present, by first staining a crushed nodule with hæmatoxylin, and then with acid fuchsin. They will be found scattered over the field of the microscope, and not arranged in definite circles.

Prognosis.—The disease runs a very chronic course, as it may last for months or even for years; when it sets up a pleurisy, the effusion may be absorbed.

Treatment.—The treatment consists in attacking the individual nodules, thoroughly removing them, and by afterwards applying chloride of zinc in solution.

INFECTIVE OSTEITIS.

Inflammatory diseases of bone have long been known in association with the exanthemata. The inflammation is an osteomyelitis, but the stress of the disease may fall, either upon the deeper layers of the periosteum and lead to its separation or to its increased functional activity, or it may fall upon the bone itself, leading to sclerosis, local or general, suppuration, or to its rarefaction. Pathology

[redacted]

[redacted] It [redacted] with the infective micro-[redacted] that they are due to the [redacted] more likely that [redacted] organisms and that [redacted] prepare the way before it. The inflammatory changes in these parts of the [redacted] and in which the [redacted] They [redacted] of the [redacted] for the [redacted] which [redacted] to replace by [redacted] from [redacted] treatment. The [redacted] pathology. [redacted] longer [redacted]

ACUTE OSTEOMYELITIS

Pathology.—[redacted] pathological [redacted] with the [redacted] which in its later stages [redacted] knowledge of this [redacted] but upon a form a basis [redacted] by experimental methods that its [redacted] The first [redacted] which was the recognition of the [redacted] that osteomyelitis was an infective disease [redacted] The second [redacted] that there was no specific [redacted] but that a variety of different [redacted] gave rise to [redacted] of clinical signs and [redacted] which in the acute form is called acute osteo-[redacted] acute septic osteitis. The third great step in

advance was made on the discovery that the micrococci were not necessarily introduced directly into the bone, but that they often gain access through some other portal. This discovery at once correlated experimental work with clinical experience, for it had been long known that the worst cases of this disease occurred after the exanthemata, the exciting cause often being the most trivial injury.

Ætiology.—It is therefore obvious that in septic osteomyelitis, as in all other infective diseases, there must be a proper soil for the growth of the organism, and this is known as the predisposition to the disease. There must be the organism itself, which in this case is circulating through the blood, and so far as can be ascertained, is daily being absorbed by the various mucous membranes which for some reason have failed to perform their protective functions. Lastly, there must be a place of least resistance where the organisms which have thus gained access to the body may settle and multiply. All these factors are found in cases of acute osteomyelitis. The child is nearly always in a debilitated condition, as it has recently passed through an attack of measles, scarlet fever, influenza, whooping cough or pneumonia, all diseases associated with the presence of specific micro-organisms.

Exciting Causes.—A slight injury to one of the bones, or the mere application of cold to a limb, may set up sufficient vascular disturbance to fit the part to act as a nidus for the organism, and the disease is started. The excellent scientific work which has been done by the Lyons School of Medicine has shown how complex are the changes which take place at the epiphyseal line of a growing bone; so that we have no difficulty in understanding why the micro-organism, in cases of acute osteomyelitis, usually shows so great a preference for this part of the bone, that many surgeons have proposed, but unadvisedly, to call the

disease by the name of epiphysitis. The developmental processes lead to the formation of many new blood-vessels, some of which are still cul-de-sacs; so that the micro-organisms remaining in the stagnant blood-stream are able to exercise their full powers for evil, by leading to an emigration of leucocytes. The disease, as it is well known, occurs in children—boys usually—from the time of birth until the union of the epiphyses has taken place; but it is less frequent in the later than in the earlier years of childhood. It most often attacks the lower end of the femur and upper end of the tibia, more frequently bones which are subcutaneous than those which are well covered (though the flat cranial bones are an exception to this rule, for they are rarely affected). Bones which grow rapidly are more liable to be attacked than those which grow slowly. It is therefore most frequent in the femur and tibia, and it is least often seen in the lower jaw and clavicle.

Varieties.—Septic osteomyelitis is met with in two forms: circumscribed when its effects are limited to the immediate neighbourhood of the part in which it starts, and diffuse when large tracts of tissue are involved. The worst possible results ensue from the diffuse form. Mr. Pick has recently pointed out that in children under one year, acute osteomyelitis is usually an inflammation of the young growing bone beneath the epiphyseal line, and as the epiphysis is cartilaginous and thin, the neighbouring joint is very frequently directly involved in the inflammation; whilst in older children, the epiphysis being less cartilaginous and thicker, the joint may escape, for the abscess may open externally. In these older children, if the joint does become involved it is by a different process, for the inflammatory products do not pass directly through the epiphysis, as in the previous case, but the whole limb being in a condition of cellulitis the inflammation tracks

round by the periosteum, and then enters at the periphery of the articulation, instead of through its centre.

The **Symptoms** of acute osteomyelitis are those of a more or less severe attack of septicæmia, but they differ somewhat with the age of the child, though in the worst forms death may take place before any coarse bone lesion is found. In very young children, in whom pain is neither felt acutely nor localised definitely, the symptoms are ill-defined. The child is noticed to be ailing, and refuses its food. It is fretful, and screams when it is dressed or moved. Careful and prolonged observation will show that one limb is kept motionless, and if this part be examined, pain can be elicited by even moderate pressure, the tender spot being situated near one of the epiphyses. If these symptoms pass unnoticed, or are allowed to go untreated, the joint often becomes suddenly and acutely inflamed, for an abscess bursts into it, and the child is then brought to the surgeon for treatment. The disease sometimes runs a less severe course, the epiphyses remain enlarged, but no acute abscess is formed. In other cases, again, the abscess tracks upwards or downwards into the soft tissues, and the joint escapes the full force of the disease; but these cases are less frequent in very young children.

Acute osteomyelitis runs its most typical course in children over two years of age, though it is commonly seen between the ages of nine and fifteen years. It begins suddenly in a delicate or debilitated child with a convulsion, or more rarely a rigour, vomiting, diarrhœa, or severe headache. The child only complains of pain near a joint if it be questioned, for it is often too ill to do so spontaneously. Its temperature rises rapidly to 105° or 106° F., with morning remissions to 102° F., and he often becomes delirious. He now presents all the symptoms of acute septic poisoning.

His tongue is dry, he has diarrhœa, he sweats profusely, his spleen is enlarged, his urine contains albumin, and he often has a little bronchitis. The *tactus eruditus* will alone detect the bone lesion during the first two days of the illness, and even that sometimes fails; but in the later stages, when the time for cure has passed, it is obvious that the bone, and perhaps the joint, is extensively diseased. A diffuse abscess, filled with purulent and blood-stained fluid, has formed, and a sequestrum of greater or less extent must be the result.

The **Differential Diagnosis** is of the very greatest importance, for there are few diseases in which so much can be done in the early stages, and so little in the later ones. There are few diseases, too, in which a mistaken diagnosis is more common. The acuteness of the onset usually leads the practitioner to think of the acute diseases with which he meets more frequently than acute osteomyelitis. He therefore attributes the attack to acute rheumatism, to cellulitis, to the onset of one of the exanthemata, to tuberculous peritonitis or meningitis, to typhoid fever, or even to scurvy, and in this way much precious time is lost. It should be a matter of routine to examine the limbs in all cases of acute illness occurring in growing children, and a moment's examination will eliminate everything except articular rheumatism. Mr. Edmund Owen has recently drawn attention to the fact that in the early stages acute osteomyelitis near the knee may be distinguished from rheumatism by gently moving the limb, and observing that the joint is normal, and that the inflammation affects the deeper tissues above or below it; whilst in the later stages, before an abscess has formed, there is a tender swelling of the ends of the bone, which is felt most readily by putting a finger and thumb upon either side of the bone and comparing it with the corresponding part on the opposite side.

The confusion of rheumatism with septic disease is no doubt due to the pernicious habit acquired by English practitioners of calling infective arthritis in all its forms rheumatism, instead of speaking in precise pathological language of gonorrhœal arthritis, scarlatinal arthritis, and other similar forms.

The **Prognosis** of acute osteomyelitis, unless it be seen in its very earliest stages, is always grave. Death of the affected bone, to a greater or less extent, is the rule; the joint may become involved, or the infective process may spread throughout the body, so that the patient dies with pyæmic symptoms. If he escapes the immediate risks of the acute stage, he may succumb to the remote effects of a long-continued suppuration, in the endeavour to cast off large pieces or even the whole shaft of bone which has died. Recent improvements in surgery, by timely operation, have materially lessened the number of deaths due to diarrhœa, lardaceous disease and exhaustion.

Operative Treatment must be adopted in every case as soon as the disease is recognised, and, if possible, before an abscess has been formed. The limb should be rendered bloodless by elevation and the application of a rubber bandage. One or more incisions should be made at once through any tender swelling right down upon the bone, and under no circumstances should the incision be deferred until fluctuation can be detected. Good will have been done to the patient even though nothing but blood escapes, for tension will have been abolished. The wound in these cases must not be closed, it should be packed with aseptic gauze and allowed to granulate. A thorough examination on either side of the epiphyseal line should be made by means of a probe if pus be found. Any opening in it should be enlarged with a gouge or burr, and the cavity into which it leads should be thoroughly scraped to remove all granu-

lation tissue. Care must be taken in doing this that the joint be not opened, and that the compact tissue is not

FIG. 2.—Photograph of a child who had a large drainage-tube passing from *A* through her shoulder-joint for twenty-eight days. It shows the free movement which often occurs in children's joints, even after prolonged suppuration.

unduly encroached upon. The cavity thus cleaned should be swabbed out with a 1 in 15 solution of zinc chloride, thoroughly irrigated with a saturated solution of boric

acid, and packed with gauze, no attempt being made to close the wound.

Attention should be directed to the shaft of the bone, if the epiphysis appears to be unaffected and there is no pus beneath the periosteum. The guarded use of a drill, gouge, or trephine, will sometimes reveal the presence of suppuration within the bone. The compact tissue in these cases should be gouged away, and the same treatment employed as has been recommended for the epiphysis. The joint in cases of secondary arthritis should be laid open, thoroughly washed out, and freely drained. It should be dressed antiseptically, and fixed immovably in the position which is the most likely to give a useful limb in case there is subsequent anchylosis. The reparative power in children is so great, however, that the recovery with a useful joint is not to be despaired of even in what appears to be the least hopeful case at the time of the operation. The following instance shows how useful a limb may be obtained after the most severe treatment of a joint. It also shows that free and prolonged drainage of a joint does not of necessity lead to its anchylosis. The details were briefly as follows:—

E. M., aged 4½, fell upon the back of a chair, striking her left axilla, on February 12, 1894. She complained of pain in the shoulder, and a week later a large abscess was found in the armpit. The abscess was incised, three ounces of pus were let out, and its cavity was scraped. As it was connected with the shoulder-joint, a counter-incision was made over the head of the humerus. The upper part of the shaft of the bone was felt to be bare, and a drainage-tube was passed through the joint from one opening to the other. The joint and the cavity of the abscess were then irrigated with boric lotion, and a dressing of cyanide gauze was applied. The tube was retained

in the wound from February 12 to March 11, and four days later the child was sent to her friends. She came to see me on August 27, 1894, and I had her photographed.

FIG. 3.—The right femur of a child. The lower half of the shaft is greatly enlarged, as a result of suppurative periostitis of an unusual character.

[*From a drawing in the Museum of St. Bartholomew's Hospital.*]

She has absolutely free movement of her shoulder in every direction, and the left arm appears to be in every respect as useful as the other (see fig. 2).

The remarkable changes which sometimes result from a stripping off of the periosteum are well seen in the annexed drawings (see figs. 3 and 4) from a specimen in the Museum of St. Bartholomew's Hospital. The bone is expanded in its lower half, and the sections show the original shaft lying in the centre of a cavity with bony walls. The space between the bony shaft and the inner edge of the wall of this cavity measures five-eighths of an inch, and

Fig. 4.—Transverse sections through the enlarged portion of the femur represented in fig. 3. The increase in the size of the shaft is seen to be due to a thick ring of new bone, separated from the shaft by a considerable space.

[*From Specimen No. 39 (b) in the Museum of St. Bartholomew's Hospital.*]

a few irregular fibrous bands extend across it. It contained pus when it was first opened. This peculiar appearance seems to be due to the fact that the periosteum was separated from the shaft by an acute inflammation which involved it without destroying its functions. The intervening space became filled with pus, and the inner layer of the periosteum formed a layer of bone round it. The child, aged one year, had only been ill a month before he died of bronchitis complicated by laryngitis. He had never been strong or healthy, but he had no symptoms of

y or rickets. The legs were swollen and œdematous. lower part of each thigh was greatly swollen, but was no effusion into the joints. The outer side of right femur fluctuated, and pus was let out through cision made seventeen days before death.

Non-suppurative Osteomyelitis.

analogous condition is sometimes met with in older ren, in whom the osteomyelitis runs a sub-acute e. It is associated with the presence of the staphylo- s pyogenes albus, and is known under the name of stitis albuminosa. The inflammation usually com- es near the epiphyses of one of the long bones, and to the formation of a swelling, which is tender, and ains a serous fluid with mucus and fat. This form be distinguished from the ordinary osteomyelitis, by low course, by the slight constitutional symptoms to h it gives rise, and by the small extent to which the is involved. The treatment consists in cutting down the swelling and scraping away its contents. It s to be the result of an attenuated virus.

Typhoidal Osteomyelitis.

still rarer form of osteomyelitis is now beginning to cognised as one of the sequelæ of typhoid fever.

tiology.—The inflammation is rarely purulent, and it s to be always associated with the presence of typhoid li, which disappear if suppuration occurs.

mptoms.—Severe pain is felt in the affected part lly during the second or third week of convalescence typhoid fever. The pain is worse at night, and the part is dependent. It most often affects the r limbs and the vertebral column. A doughy or ic tumour after a time develops at the seat of the

pain. The temperature is raised, and it may be of the hectic type. There may be considerable wasting.

Course.—The swelling may be absorbed, leaving a temporary periostitis. Its contents may caseate, and it may then open spontaneously. In some cases it liquefies, when the surface of the bone may become affected, or a sequestrum may be produced.

Treatment.—The treatment consists in cutting down upon the swelling before it has undergone secondary changes. Its contents should be removed with a sharp spoon, and an attempt should be made to get union by first intention.

Sequelæ of Suppurative Osteomyelitis.—Necrosis does not often take place, even in the most acute forms of septic osteomyelitis, for some days after the onset of the symptoms. Dr. Macewen points out that the bone dies as a whole when the periosteum is raised from the shaft and the nutrient vessels either become occluded by thrombosis or embolism, or are ruptured. Superficial necrosis, on the other hand, occurs when the periosteal blood supply is cut off from the portions of the shaft of the bone, whilst the nutrient arteries remain intact. When the bone has been exposed in a case of osteomyelitis it is often found to be white and bare, and if the nutrient arteries are intact it gradually becomes covered with granulations, but if they are blocked the bones remain white. The signs denoting the presence of a sequestrum are often obscure, especially if it lies deeply in the bone, for it is then likely to be mistaken for a new growth in the bone. There is usually no difficulty in detecting dead bone when it lies loose at the bottom of a sinus whose orifice is guarded by a mass of granulation tissue. Its presence can only be guessed at when there is no sinus, in cases where after an attack of osteomyelitis the bone is enlarged, thickened and pain-

ful, for chronic osteitis may produce a similar condition. A cautious surgeon will therefore hesitate to perform an operation for the removal of a sequestrum unless he has clear evidence of its presence, or unless the suppuration is so extensive as to threaten the advent of lardaceous disease. It is sometimes necessary to remove the dead bone as soon as possible when the whole diaphysis has perished, especially if it be the radius, ulna, or fibula; but caution must be exercised in the case of the tibia, femur, and humerus. It sometimes happens, if the bone be too early removed, that the osteogenetic properties of the periosteum are not sufficiently developed to form an entire new shaft, even with the assistance of the epiphyses, and an insecure limb results. When this happens, means must be taken to stimulate the inner layer of the periosteum by the introduction of foreign bodies, which will remain aseptic. It is generally wise to allow an interval of two months to elapse in the upper extremity, and three months in the lower, before attempting to remove an extensive sequestrum, and in the meantime free drainage must be allowed, and the limb should be kept at rest upon a splint.

Treatment of Sequestra.—A sequestrum is removed either as a whole or piecemeal as soon as it is felt to be loose. The child is anæsthetised for this purpose, its limb is rendered bloodless by means of an Esmarch's bandage, and the sinus is enlarged, the cloaca is then explored and gouged away until the sequestrum can be withdrawn with a pair of strong forceps. The gouge has often to be supplemented by cutting forceps, Hey's saw, or a trephine. The cavity in which the sequestrum lay is thoroughly scraped until pink bone is reached and until blood oozes from the Haversian canals. The diseased skin and the granulation tissue at the orifice of the sinus is also scraped away, and all the parts are swabbed with a solution of chloride of

zinc (15 grains to the ounce), and afterwards flushed with warm boric lotion. The cavity is then packed with dry gauze, or in very young children the gauze is moistened with camphorated naphthol, and the wound is allowed to granulate from the bottom: a process which takes several weeks. The secretions must not be allowed to collect in the wound, and repeated dressings are therefore necessary. In children it is only necessary to amputate the limb in very exceptional cases.

Rarefaction and Sclerosis of Bone.

Sinuses discharging a thin pus, unhealthy scars showing a constant tendency to break down upon slight provocation, and residual abscesses are very frequent sequelæ of an attack of osteomyelitis. So frequent and so well known are these sequelæ that the tragedian made Philoctetes suffer from such an issue in that play which, though it is not the greatest of its author's creations, has yet an abiding interest for the surgeon, for it depicts a case of infective osteomyelitis terminating in sclerosis as it was presented to an Athenian audience 2,400 years ago. The treatment in all cases consists in cutting down upon the inflamed spot, and drilling the bone towards the epiphysis in those cases where there is much pain apparently associated with circumscribed collections of pus. The bone must be trephined if pus is found, and the abscess is then treated in the same way as the sequestrum cavity. The carious bone is gouged away if a discharging sinus remains, and the wound is allowed to heal under antiseptic dressings.

WHITLOW.

The term whitlow is clinical rather than scientific, and it is employed loosely to denote any infective inflammation affecting the tissues of the fingers. It is one of the most

troublesome and painful of the minor affections to which children are liable.

Varieties and Ætiology.—(1) In its simplest form it is a localised inflammation of the skin of the finger, the result of direct inoculation after a slight injury.

(2) The superficial or subcutaneous whitlow is generally found about the nail and the finger-tips of children who are thoroughly out of health, or in those who have recently suffered from one of the exanthemata. It is often associated with eczematous patches upon other parts of the body.

(3) A whitlow may run the ordinary course of a case of infective osteomyelitis, terminating in the death of one of the phalanges, usually the terminal one, though either of the others may be affected. It follows a slight blow or sprain, or it may be produced by a punctured wound.

(4) The most severe form of whitlow is that known as the thecal abscess. It is formed inside the sheath of the flexor profundus digitorum tendons. It is an infective inflammation, originating like the other forms in a very slight puncture or in a poisoned wound.

(5) Painless whitlow is a rare form occurring in syringomyelia. It is of trophic origin, and was first described by Morvan. It is said to run a chronic and painless course, and may lead to complete destruction of the terminal phalanx.

Symptoms.—The symptoms in the slightest cases are local pain, followed in the course of a few hours by reddening of the skin without any great swelling.

The subcutaneous whitlow causes much pain, with localised tenderness and inflammation. The finger-tip is not much swollen, but a blister is formed upon it usually of considerable size, and often produced upon more than one phalanx. The blisters are opaque, and contain a purulent fluid.

Diagrams showing the usual and the commoner forms of irregular arrangement of tendon sheaths in the hand (from Testut's Anatomie Humaine).

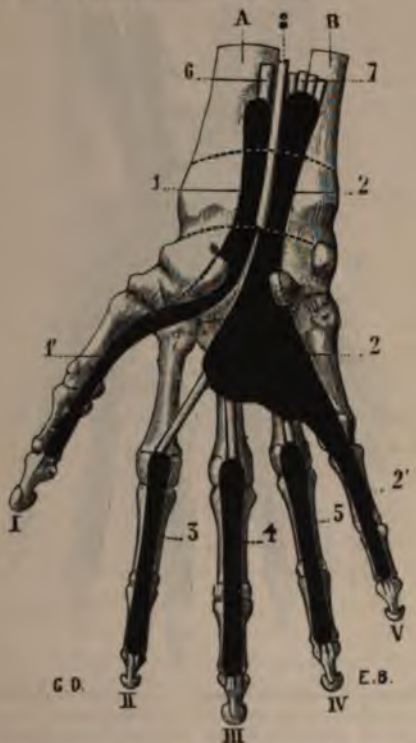

FIG. 5.—Diagram showing the ordinary arrangement of sheaths of the flexor tendons of the forearm (from Testut's *Traité d'Anatomie Humaine*). *A*, radius; *B*, ulna; *I.*, *II.*, *III.*, *IV.*, *V.*, indicate the thumb with the index, middle, ring, and little fingers respectively; 1, the external carpo-phalangeal synovial membrane continued downwards as 1' the phalangeal synovial membrane of the thumb; 2, the internal carpo-phalangeal synovial membrane continued downwards as 2' the phalangeal synovial membranes of the little finger; 3, 4, 5, the three phalangeal synovial membranes of the second, third and fourth fingers; 6, the tendon of the flexor longus pollicis; 7, 7, the tendons of the flexor profundus digitorum; 8, median nerve. The dotted lines represent the position of the anterior annular ligament.

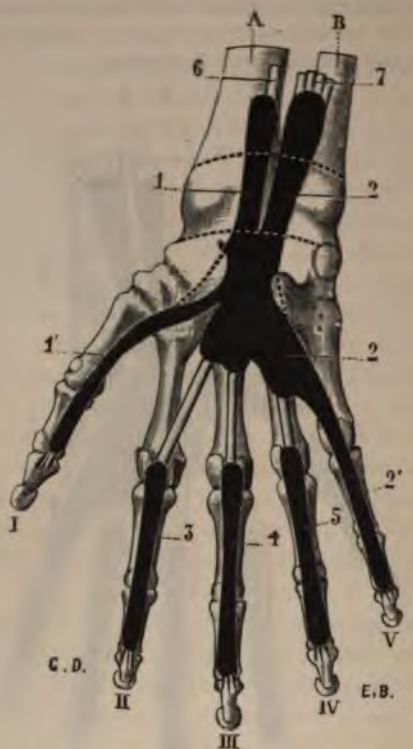

FIG. 6.—Diagram showing an abnormal arrangement of the sheaths of the flexor tendons in the forearm (from Testut's *Anatomie*). The references are the same as in the preceding figure. The two carpo-phalangeal synovial sheaths have coalesced at the wrist.

The whitlow caused by osteomyelitis is attended by much throbbing pain in the terminal phalanx, with great constitutional disturbance. Pus is quickly formed, and slowly makes its way to the surface unless it is let out by a timely incision. The phalanx dies as a whole, but the t[illegible]th is not as a rule involved. Sinuses are

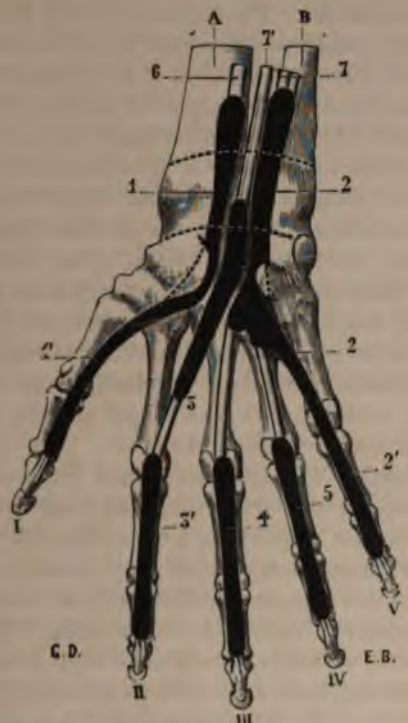

FIG. 7.—Diagram showing another abnormal arrangement of the sheaths of the flexor tendons in the forearm (from Testut's *Anatomie*). The references are the same as in fig. 5. There is a separate synovial sheath in this form for the carpal portion of the long flexor of the index finger 7'. The phalangeal portion of the sheath, however, 3', remains distinct.

formed in cases which have been left untreated, and through these sinuses the necrosed bone may readily be removed.

The inflammation, in cases of thecal abscess, runs a very acute and severe course. It may lead to much constitutional disturbance, and it may terminate in sloughing of

the tendons affected. The diagrams (figs. 5, 6 and 7) copied from Testut's *Anatomie* show the usual and the two unusual forms of the arrangement of these important sheaths in the hand and the forearm. When they are inflamed the abscess is likely to extend through the hand, especially if the thumb or little finger is involved, as in these digits the synovial sheaths are in direct connection with the synovial membrane beneath the annular ligament at the wrist. Dr. von Rosthorn, however, has shown that in new-born children each of the fingers possesses a separate phalangeal synovial sheath which does not communicate with the carpal sac. In early childhood the tendon sheaths of the thumb and little finger gradually extend backwards until they coalesce with the carpal sheaths to form the adult condition represented in fig. 5.

Treatment.—Whitlows are always evidence of greatly impaired health, and when they are recurrent, as is frequently the case in children, I think that they imply bad hygienic surroundings, or that they indicate a strumous condition which is especially liable to pass on into tubercle if the necessary bacillus is forthcoming. The general health should therefore be attended to in every case, and the defective hygienic surroundings should be remedied.

Quinine should be given for a day or two, and the child should then be placed upon a course of carbonate of iron in some agreeable form.

The simplest cases may be treated by compresses of absorbent wool soaked in a 1 in 20 solution of carbolic acid.

The fluid in a subcutaneous whitlow should be let out by incising the cuticle, which is an absolutely painless proceeding, and by afterwards fomenting the inflamed part with a solution of boric acid containing 20 grains to the ounce.

When the inflammation is produced by osteomyelitis, and there is much pain and swelling, an early incision carried along either side of the affected phalanx through the condensed cellular tissue, until the point of the knife touches the bone, relieves the pain, and at the same time renders necrosis less likely to occur. So long as the inflammation persists, the affected hand should be soaked for an hour or more once or twice a day in an arm-bath or basin containing a solution of corrosive sublimate of the strength of 1 in 2000 at a temperature of 100° F. The hand must be dressed antiseptically in the intervals, and suspended in a sling. The epiphyseal end of the phalanx often escapes in these cases, so that a shortened but useful finger results.

Thecal abscess I have only seen in boys after twelve years old. Mr. Morrant Baker[6] points out that a thecal abscess can be distinguished from the whitlow due to osteomyelitis by the early impairment of voluntary movement in the distal phalanx. He recommends that, in order to estimate the movement of the tendon within its sheath, the second phalanx of the finger should first be fixed by the surgeon, who places his thumb on the front of the second phalanx and the end of one of his fingers of the same hand on the back of the first phalanx. The patient is now told to bend his finger, and the surgeon will then be able to recognise, both by sight and by touch, the range of movement, if any, still possessed by the tendon. If the terminal phalanx remains motionless, the presumption is that by some means the profundus tendon is tethered. It often happens, on the other hand, that the patient can bend the tip of this finger under these conditions, even when the finger has been long and extensively inflamed; and when this happens, we are to give a favourable prognosis, for we are taught thereby that

the inflammation has been in the deeper tissues lying beneath the tendon sheath. A stiff finger, however, often follows upon this form of whitlow.

The **Treatment** consists in making a small incision into the sheath of the tendon opposite the head of the metacarpal bone, for this is the lowest point reached by the synovial membrane, except in the thumb and little finger.

When the inflammation extends up the arm, along the synovial sheaths upon the inner and outer side, the whole hand becomes acutely inflamed, and the swelling and puffiness are especially marked upon its back. Unless very active measures are taken, abscesses form and burrow amongst the tendons of the forearm, and the patient goes in serious danger of his life.

Free incisions must be made in these cases into the palm of the hand, along the metacarpal bones anterior to the superficial arch. The scalpel must only be used to divide the skin and fascia, the deeper tissues being separated with a director until the abscess is laid open. A counter-opening must also be made above the annular ligament, between the tendons of the flexor carpi radialis and the palmaris longus, and a drainage-tube should be passed under the annular ligament between the two openings. The hand and arm, as in the previous forms, should be kept for two or three hours a day in an arm-bath containing a solution of 1 in 1000 perchloride of mercury, at a temperature of 100° F., antiseptic dressings being applied between the immersions. Stimulants, quinine, and good food are imperatively necessary. Patient and prolonged attempts at passive movement must afterwards be carried out.

CHAPTER IV

SURGICAL TUBERCULOSIS

Ætiology.—Tuberculous disease occurs so frequently and is so fatal in childhood, that it has been estimated that it kills one-third of the children who annually die in hospitals. Tubercle in adults is often localised, and is very frequently pulmonary; in children it is much more often generalised. My friend, Dr. Walter Carr, indeed finds, as a result of extended observations in the *post-mortem* room attached to the Victoria Hospital for Children, that the primary focus of tubercle occurred in the lymphatic glands in 72·5 per cent. of cases in which the children died of this disease, and of these no less than 65·8 per cent. commenced in the glands of the thorax or abdomen. He points out, however, that these statistics do not fairly represent the cases of tubercle starting in joints and bone, for such cases do not usually die in hospitals. The bacilli doubtless gain access by small local lesions directly to the lymphatics, and so to the gland, the organisms being originally obtained either from inhalation or from the ingestion of contaminated milk, as Dr. Woodhead has suggested. When once they have obtained a local habitation, they readily spread through the lymphatic system in persons who present them with a congenial soil. The varying receptive power offered by different persons is no doubt always due to heredity, but the tendency can be diminished by hygienic means, even in the most susceptible.

Pathology.—The tubercle bacillus, by the irritation it produces, gives rise to an aggregation of leucocytes; which, undergoing slight modifications, are known as miliary tubercles. If tubercle bacilli, and tubercle bacilli only, are present, the cells grow and fuse, finally undergoing changes in the direction of the formation of fibrous tissue. If, on the other hand, the ordinary septic bacilli are mixed with the tubercle bacilli, as most often happens, suppuration takes place, and the various forms of tuberculous abscess result. It is, therefore, of the utmost importance that all wounds in connection with tuberculous tissues be kept thoroughly free from contamination with septic micro-organisms, for only by such care can the surgeon benefit the patient upon whom he operates. Drainage-tubes are therefore inadmissible, except under special circumstances.

Tuberculous disease, so far as it is interesting to the surgeon, affects the lymphatic glands, the bones, the joints, and bursæ, the pleura, the peritoneum, the kidney, the testis and the skin. Tuberculous disease of the brain, leading to the formation of caseating masses or to a subacute inflammation of its meninges, is of more doubtful interest to him; as, although operations have been performed for the relief of cerebral tuberculosis, they have not yet been attended with sufficient success to warrant any recommendation of them for general use.

Disease of the lymphatic glands is one of the most frequent of the primary manifestations of tubercle. No surgical measures are of service for the relief of the bronchial and mesenteric glands which, as Dr. Carr's statistics show, are most commonly affected, for they are beyond the reach of operative treatment, but much can be done for the cure of those glands which are more superficially placed.

TUBERCULOUS LYMPHADENITIS.

Varieties.—Tuberculous infection in the lymphatic glands manifests itself as it does in other parts in many ways. Sometimes there is a simple hyperplasia of the glandular substance, which does not necessarily involve the capsule, so that the individual glands remain separate and distinct; in other cases they are matted together, and are embedded in such dense fibrous tissue that it is very difficult to remove them; whilst in other cases, again, they suppurate and form either a diffuse abscess or a localised bag of pus. The tuberculous infection is often limited to the glands, when it is frequently the mildest form in which the patient can have the disease—no doubt, because the gland tissue has the power of destroying the infective material—in other cases the tuberculous adenitis is secondary to, or is a part of, a generalised tuberculosis. Children under ten years of age are especially liable to this form of tuberculous disease, and in its primary form it is more often seen in the glands of the neck than in other parts.

Prognosis.—The prognosis as regards life and dissemination is good in the case of glands situated within the reach of surgery, but local infection of the skin often occurs, leading to unsightly scars.

Treatment.—The treatment of tuberculous glands is either palliative or operative. It should be remembered that enlarged glands in the necks of children are not always tuberculous, for they are often associated with local irritation. The removal of lice, eczematous inflammations, carious teeth, mastoid abscesses, chronic otitis media, and other local causes, will generally lead to a reduction in the size of the affected glands, and often to their com-

plete recovery. Local remedies should also be tried in every case. The judicious application of iodine, or of an ointment containing mercury or potassium iodide, with the administration of one-drachm doses of cod-liver oil directly after food, and a quarter of a grain of grey powder before each meal, will be found most serviceable. The patient should, if possible, be sent to Margate or to Broadstairs for a thorough course of fresh air.

Operative means must be adopted when these measures have failed, or when, as often happens, the child is brought at too late a period for them to be tried. Few departments in surgery have undergone so rapid and radical a change as that appertaining to the removal of enlarged tuberculous glands. The palliative method was alone employed until 1885, when Dr. Clifford Allbutt and Mr. Pridgin Teale, who were then colleagues at the Leeds General Infirmary, pointed out that the proper treatment lay in the complete extirpation of the glands as soon as it was clear that constitutional measures were unavailing to prevent caseation, and that in no case should they be allowed to suppurate. Their practice and advice has been so largely followed, that the early removal of tuberculous glands is now the rule amongst all surgeons; the only contra-indications being the extreme weakness of the patient, or the fact that the enlargement is part of a general tuberculosis.

The glands most frequently requiring removal are those occurring in the neck, beneath and along the anterior border of the sterno-mastoid muscle; the glands in the anterior fold of the axilla, and the superficial and deep glands in the groin.

The indications for the removal of tuberculous glands are their size and their condition.

When they are so large as to cause disfigurement, and there is the slightest indication that they are about

to suppurate, they should be extirpated without delay. The incision, in the case of the neck, must be planned so as to lead to the smallest amount of disfigurement, and advantage should therefore be taken of natural lines and creases.

Operation.—The incision should be linear, and of sufficient size to enable the surgeon to see clearly what he is doing; for glands are nearly always more deeply situated than they appear to be before the operation is commenced, and serious injury may be done to the arteries, veins, and nerves of the neck, unless great care be taken. Lastly, every effort should be made to obtain union by first intention. This can usually be effected if asepsis be ensured, and care be taken not to infect the skin and tissues by opening the capsule of the gland. The incision should be carried on until the capsule is reached, the knife should then be laid aside, and the gland freed with a blunt-pointed steel director. It should be raised between the finger and thumb as soon as possible, as the capsule is liable to be injured and the wound infected if it be seized with a vulsellum. The gland can often be pulled out quite easily, but in many cases it will be found that the capsule has become adherent to the surrounding tissues, owing to the chronic inflammatory processes to which it has been subjected. It is then absolutely necessary to cut through the adhesions, but the division must be done with the greatest care and deliberation; for even large nerves like the hypoglossal and the spinal accessory may be divided; whilst hæmorrhage from injury to the vessels is not infrequent. All bleeding points must be arrested at once, either by ligatures or by the use of pressure forceps, as it is of the greatest importance that the wound should be kept bloodless, that the surgeon may see what he is doing at every stage of the operation.

Several glands can generally be removed through a single well-planned incision, especially if there be a skilful assistant who knows how to make each in turn prominent. It is, however, better to make two or three incisions rather than to endeavour to dissect blindly or extensively. The sterno-mastoid itself sometimes requires division, but this is not a serious proceeding, as in such cases it has become thin and atrophied from the pressure of the glands beneath it. Its cut ends must afterwards be sutured.

The greatest gentleness of manipulation is required when the glands are caseating, and if they have already suppurated, but with care they may be moved unruptured. It too often happens that the abscess has become diffuse before the patient is seen by the surgeon. It is then necessary to lay it open, remove the pus, and look carefully for the remains, or for the capsule of the gland. The abscess is often superficial, whilst the gland is situated deeply beneath the cervical fascia. The sinus leading from the abscess to the gland must be cautiously enlarged, and all the caseating material must be carefully scraped away with a sharp spoon, the cavity being afterwards swabbed out with a solution of 1 in 15 zinc chloride, or with a solution of camphorated naphthol, and afterwards well flushed with a boric lotion. Several cases of poisoning have occurred after the use of camphorated naphthol, so that it is better not to leave any large quantity of the solution in the abscess cavity. The same treatment must be adopted when the skin is undermined, and is riddled with fistulous tracts. It is often advisable in these cases to cut away the skin clear of the disease, as there is less chance of subsequent infection than after scraping. The skin-wound, in either case, should be brought together with point sutures of horsehair, taking care that the edges are in exact apposition. It is then dressed with sterile or cyanide

gauze, and usually heals by first intention, if care be taken to keep the head at rest. Many surgeons prefer to dust the wound with iodoform, boric acid, or nitrate of bismuth; but I find that such applications are unnecessary, as the repair takes place equally well without them. The sutures should be removed as soon as possible, and usually on the third or fourth day, when, if there is no discharge, the dressing is changed for a layer of gauze, kept in place by collodion.

Tuberculosis of the various Mucous Membranes.

This form of tuberculosis is rather frequent in children. The tubercle appears either in the form of circular ulcers, each with a well-defined outline, or as masses of granulation tissue. They may be seen in the septum nasi, in the mouth, on the tonsils, and in the pharynx. The local manifestation should always be removed early and completely, unless it forms part of a general tuberculosis; or unless it be situated in a part like the pharynx, where an operation can only be palliative, and for such a place the electro-cautery may be employed. (See also chap. xiii.)

Tuberculous Disease of the Tendon Sheaths.

This is fairly common in childhood. It may begin in the sheaths themselves, or it may be secondary to bone or joint lesions. The inflammatory process either gives rise to the formation of much granulation tissue, or it may in rarer cases produce a cystic distension of the tendon sheaths. The extensors of the fingers are more often affected than the flexors.

Prognosis.—The prognosis is good so long as suppuration does not take place; though the secondary forms are unsatisfactory, owing to the unhealthy state of the surrounding parts.

Treatment.—A clean sweep should be made of the whole of the affected tissue by careful scraping, under the strictest antiseptic precautions.

PRIMARY TUBERCULOUS INFECTION OF THE SKIN.

The skin is sometimes the primary seat of tubercle, and of this a good example recently came under my notice. A healthy student, who had no tuberculous relations, scratched his knuckles whilst making a *post-mortem* examination of a tuberculous heifer, and the sore place never healed properly. Four months later, when he applied to me for advice, there were three small circular patches, each surrounded with an inflamed zone, lying immediately over the right extensor indicis tendon. The centre of each patch was a scab. The growths were removed, and were subjected to microscopical examination. They consisted of granulation tissue, containing giant cells, but no tubercle bacilli were detected. A year later the patient was in perfect health. Such cases are not very uncommon, and when there is reason to suspect their tuberculous character, excision is the best mode of treatment. In most cases, tuberculous inflammation of the skin is secondary, and the result of direct extension from other and deeper tissues, as from a case of tuberculous lymphadenitis. The sores produced in such cases are puckered, blue, and often very unsightly. They often show a great tendency to break down.

LUPUS.

Ætiology.—Lupus is defined by Professor Leloir as a slightly virulent form of tuberculosis of the integuments. The elementary lesion is a tubercle, reddish brown in colour, soft in consistence, developing slowly, and destroying the tissues either by interstitial absorption, by ulceration, or by sclerosis.

Pathology.—Lupus may attack any part of the skin or the mucous membrane adjacent to it. It generally begins in infancy, and may produce a partial or general infection of the system. The primary lesion is either nodular or diffuse. Its tuberculous character has been demonstrated by the production of general tuberculosis in animals who have been inoculated with lupus; and there appears reason to suppose that lupus in a child is often the result of direct inoculation from an external source, though it may sometimes be the result of auto-infection. It is characterised microscopically by the large number of giant cells contained in the growth. The cells caseate rather less rapidly than in an ordinary tuberculous nodule, and the infiltrated area is somewhat more vascular. The tubercle bacilli are very few in number.

Course.—The affection may continue throughout life, and often causes lasting deformity. It attacks, by preference, the nose and cheeks, and it often begins symmetrically upon either side of the face, the two patches afterwards extending and becoming connected across the nose. It may also affect the pinna of the ear, and more rarely the skin in the neighbourhood of the joints, whose movements it may seriously hamper by ulceration and cicatrisation of the skin. It hardly ever attacks the genital organs either in girls or boys. I have seen it spread from the upper lip to the gums and tongue, causing extensive ulceration.

Diagnosis.—It has to be distinguished from some forms of eczema and from cutaneous syphilides. Its chronic course will distinguish it from either unless, as often happens in hospital practice, syphilis and tubercle are coexistent.

Treatment.—Lupus, at any rate, in children is no longer the bugbear that it was to the older surgeons.

Scraping and skin-grafting have enabled us to do something towards its cure, though there are frequent relapses, and scarring is unavoidable. The treatment I usually adopt is one which was, I believe, originally introduced by Mr. Arbuthnot Lane, and it often yields excellent results. The patch of lupus and the surrounding skin is disinfected as far as possible overnight, and is protected with a gauze dressing. An anæsthetic is given on the morrow, and the whole of the diseased area is scraped away with a sharp spoon, especial care being taken to destroy every part of the sinuous edge and all outlying patches. The diseased area is readily recognised by the readiness with which it breaks down under the scoop, whilst the healthy tissue grates and shows no tendency to be removed. The bleeding is stopped by pressure, and precipitated sulphur is sprinkled over the whole of the raw surface, which is then dressed with dry cyanide gauze. The sulphur produces a superficial and very complete slough, which separates on the fourth or fifth day, leaving a healthy granulating surface. It should then be dressed daily with boracic ointment, the wound being bathed with a solution of boric acid.

Skin-grafting by a modification of Thiersch's method (*q. v.*) is adopted as soon as the wound is clean; for routine purposes, this is a week after the scraping. The grafts are usually taken from the anterior aspect of the thigh. The part is disinfected and an antiseptic dressing is applied on the day preceding the operation. The patient is anæsthetised, and the wound, as well as the skin of the thigh, is washed with a solution of perchloride of mercury, 1 in 2000. The skin-grafts are shaved off with a broad razor, moistened with a 0·6 per cent. solution of common salt. The grafts should be as long and broad as possible, and they should be sufficiently numerous to cover

the whole of the wound. They are best obtained by flexing the leg and thigh, and by then stretching the skin with the thumb and forefinger of the left hand. The razor is made to cut through the tops of the cutaneous papillæ, so that a slight oozing of blood marks its course. The mistakes most frequently made are not to cut with sufficient boldness, so that the grafts are too small and too thin, for they will then only consist of squamous cells; on the other hand, an operator whose hand is heavy or whose sight is bad, cuts too deeply, so that his grafts have an under surface of fibrous tissue or fat, often covered with a layer of blood, which clots. Grafts which are properly cut have a slimy feel and are pale in colour. They have a great tendency to curl up, so that it is better to float them from the razor straight on to the wound. They should be fitted together by means of a probe, in such a way that their edges slightly overlap. A piece of green protective, moistened with a sterilised salt solution, is then placed over the wound, gauze dressings are applied, and the part is not dressed for a week. It will usually be found that most of the grafts have taken, whilst the parts which remain uncovered are rapidly healed by the surrounding epithelium. The thigh is dressed with antiseptic dressings in the ordinary manner.

Many surgeons have followed the plan introduced by Mr. Watson Cheyne, of dissecting out lupus patches, making an incision through the healthy skin, and removing the subcutaneous fat over the infected area. The bleeding is staunched and the wound is immediately covered with skin-grafts.

CHAPTER V

TUBERCULOUS DISEASE OF BONE

tiology.—Tuberculous osteitis[7] is one of the commonest ne diseases seen in children. It affects all the bones, ıg and short, cylindrical and flat, cartilaginous and ımbranous. It is frequently a mixed infection, but in ne cases, and especially in the phalanges and meta- rpal bones, the inflammation may be due to the tubercle cillus alone, without any intermixture of septic organ- ns. Tuberculous osteitis seems to occur spontaneously many cases, for it is often impossible to obtain a history any exciting cause, but it usually follows an injury.

Pathology.—The tuberculous deposit is found typically the cancellous tissue, but it may occur deeply in the bstance of the compact bone, beneath the cartilages or b-periosteally. The labours of Lannelongue, Ollier, and her members of the great French school of scientific rgery, have proved that tuberculous disease of bone ry often begins in the long bones as a localised deposit the neighbourhood of the epiphyseal line.

Anatomical Characters.—The deposit of tubercle, as it seen in its earliest condition, consists of minute nodules ing in the cancellous tissue. These nodules rapidly ıdergo caseation, and coalesce, in some cases leading to ry little damage, but usually causing absorption of the ne, by setting up a process of rarefying osteitis. The

caseated products sometimes undergo absorption, they may become converted into fat, but much more frequently suppuration occurs, and the bone becomes carious. In the long bones, the process of suppuration may be very chronic, and does not give rise to many symptoms, so that a chronic abscess of bone may result; in other cases the suppuration may be much more acute, and may lead to the destruction of a fragment of bone which then lies in an abscess, the condition being known as "caries necrotica." Necrosis, however, is not a common result of tuberculous osteitis in children; and it only occurs in cases of mixed infection. The disease ends either in destruction of the bone, and its replacement by scar tissue of a fibrous type, or in condensation of the bone, owing to the continued irritation to which it has been subjected. This sclerosis is often so complete that such a bone as the tibia may consist entirely of compact tissue; in such cases it is often longer than its fellow and much more curved.

Symptoms and Course.—The symptoms of tuberculous inflammation of bone vary greatly. It occurs in the simplest form, in tuberculous inflammation of the fingers or toes (p. 70) and in the bones of the carpus and tarsus. The pain in these cases is only slight and of a pricking character, worse at night, and when the part is subjected to pressure or when it is moved. The bone is often expanded, and its interior is converted into a mass of softened tissue, which leaves a mere shell of compact tissue when it has been removed. The skin, at first unaffected, afterwards may become involved in a true tuberculous inflammation. These symptoms subside in the simplest cases, and a slow but spontaneous cure may result. A mixed infection, however, is much more frequent: an abscess forms which opens externally, leaving a fungating sinus, along which the disintegrated portions

of bone pass for long periods of time. The sinuses may eventually close, and a depressed and puckered scar remains to show where they were. In the worst forms, sequestra may be produced, or many bones may become involved in the carious process. The skin and surrounding tissues become widely involved, the joints are implicated; and unless amputation be performed, there is danger of death from lardaceous disease; or if the bone lesion be part of a general tuberculosis, from cerebral meningitis.

Diagnosis.—The diagnosis is usually easy, but where there is a deposit of tubercle deeply seated in one of the long bones it is extremely difficult to recognise, and it is then likely to be mistaken for chronic osteomyelitis, or for a sarcomatous growth within the bone. Verneuil says that tuberculous osteitis can be distinguished from a sarcoma by the greater pain attending the malignant growth, and by the fact that the temperature of the affected limb is two or three degrees higher than its fellow; whilst in tuberculous osteitis such a difference in the heat of the two limbs does not occur.

The differential diagnosis has to be made between a new growth and inflammatory swelling of bone, and this can best be done, as Mr. Howard Marsh has very ably pointed out, by paying attention to the following points. Osteitis is more common in children than a new growth. An injury is more likely to lead to an inflammation of bone than to a sarcoma. A uniform swelling of the bone is more likely to be inflammatory than a lobed, nodular or irregular one. Sarcomata in children are often very soft, whilst the inflammatory swellings are densely hard. The rate of growth affords very little information, for in both forms of swelling it may be slow or rapid. The condition of the skin overlying the tumour is not a much more trustworthy guide than the rate of the growth, whilst the body tem-

perature in inflammatory conditions is generally subject to greater variations than in sarcoma. The symptoms, however, are often so similar in the two conditions that it is impossible to make an accurate diagnosis, though usually they are so distinct as to render a mistake impossible.

Prognosis.—No general rule can be laid down in regard to the prognosis, for so much depends upon the position as well as upon the extent of the disease. Each case therefore has to be considered upon its merits.

Treatment.—The first treatment to be adopted in every case of tuberculous osteitis consists in rest of the affected part, with an improvement of the patient's health by sending him to the seaside, and preferably to some bracing place, as well as by the administration of cod-liver oil. The tubercle bacillus has so uncertain a tenure of life that in many cases the disease can be cured by these means. Physiological rest is best secured by the application of a plaster-of-Paris splint or by a Thomas' splint.

Operative interference is called for when the local symptoms do not speedily subside under this treatment; and when pyogenic, as well as tubercle bacilli, are present, this can hardly be expected. The surgeon then endeavours to remove the tuberculous foci as completely as possible. An Esmarch's bandage is therefore applied, the bone is exposed, all the unhealthy tissue is scraped away, the cavity is treated with zinc chloride, washed, and an endeavour is made to obtain union by first intention. I used to fill the cavities with iodoform, camphorated naphthol, bismuth, boric acid, or other disinfectant; but as time goes on I find myself less inclined to use any antiseptic in these cases, and to trust entirely to aseptic methods when the disease has once been removed completely, for I am sure that the best results are obtained by their means. When there has

been prolonged suppuration, however, and union by first intention is impossible, the ordinary antiseptic solutions must be employed. Amputation is sometimes necessary in cases of tuberculous osteitis which have been neglected. It is especially useful in the foot, where the whole of the tarsal bones are often so extensively diseased as to render it the only available method of treatment.

TUBERCULOUS DISEASE OF THE LONG BONES.

(1) Epiphyses.

Tuberculous disease affects either the epiphyses or the shafts of the long bones. The epiphyses are rather more frequently implicated, and the disease assumes the form of an osteomyelitis, leading either to fungation, to necrosis, or to infiltration of the affected tissues. The fungating form often leads to implication of the joint, and is described more fully at page 98. The necrosing variety leads to the formation of an abscess in the head of the bone, which can be distinguished from that due to septic osteomyelitis by the fact that it is less frequently surrounded by a layer of dense bone, though it has a much better defined pyogenic membrane. The sequestra vary, for they are sometimes small and caseating, sometimes larger and wedge-shaped. These cuneiform masses can be produced artificially by injecting tuberculous substances into the nutrient artery of the bone, and it therefore appears as if they had an embolic origin. The infiltrating form of tuberculous osteomyelitis is the least common and the most unsatisfactory to treat, for it progresses steadily, and is often associated with extensive suppuration.

Course.—The disease runs a very chronic course, and may terminate in a chronic abscess near the head of the bone, which may remain for years, and may then open to

the exterior or into the joint; in other cases rapid fungation may take place, and with similar results. The surrounding tissues often become involved in the tuberculous process, and a complicated system of sinuses is developed, which lasts for years if it is left without treatment.

Symptoms.—The symptoms are generally very obscure when the tubercular deposit takes place deeply in the epiphyseal line, and it is often only discovered accidentally on making a section of the bone, after death, or after it has been removed for some other reason. It is more easy to recognise when it occurs in the superficial than when it is in the more deeply seated bones, and more easy when it suppurates than when it is encysted. The symptoms upon which alone any reliance can be placed are pain, swelling, local tenderness, redness when the skin is becoming involved, and atrophy of the muscles, due some think to disuse, whilst others hold that it is a result of nervous disturbances in the affected part (see also pp. 74 and 114).

Prognosis.—The prognosis upon the whole is not so serious as it was forty years ago, when constitutional measures were relied upon to the exclusion of all other means except amputation. The disease is always tedious and often dangerous, but with care and repeated atypical operations good results are often obtained.

Treatment.—The general treatment consists in removing the cause, if possible, by improving the general tone of the tissues, and so enabling them to destroy the bacillus; if this is not feasible, by injecting such sclerosing agents as zinc chloride (p. 102) to convert the inflammatory products into fibrous tissue, or else cutting down upon the part and removing the products of tuberculous action, for when this is done the inflamed tissues are often found to

be capable of preventing the further growth of the tubercle bacillus. It is essential, however, that the parts should be kept strictly aseptic. In tuberculous infection of the epiphyses, a thorough exploration of the epiphyseal line should be made as soon as there is evidence that the inflammatory focus has suppurated, for there is great danger lest the joint become involved either by the direct spread of inflammation or by sympathy.

(2) Shafts.

Tuberculous osteitis of the shafts of long bones is either primary or secondary when it results from extension from the epiphyseal line, and this is the more common form. The inflammation runs the same course, and presents the same obscure symptoms in its earlier stages as in the similar condition of the epiphyses. Necrosis, however, is somewhat more common, and in some cases the bones become the seat of a remarkable form of rarefying osteitis, which is more fully described at page 70, and leads to the formation of a condition known as spina ventosa. The sequestrum is sometimes situated between the laminæ of the compact bone, and its presence is attended by suppuration. The bone then slowly enlarges and becomes painful, and the condition is likely to be mistaken for a sarcoma; in other cases condensation and sclerosis of the entire bone may take place. The disease is more often an osteomyelitis than a periostitis, though the periosteum is involved in the later stages. The general treatment is the same as in the epiphyseal infection.

TUBERCULOUS DISEASE OF THE SHORT AND OF THE FLAT BONES.

In the *skull* tuberculous disease sometimes affects the frontal and parietal bones, though the mastoid may be

implicated secondarily from the middle ear (*q.v.*). An abscess pointing externally, ornecros is of the whole thickness of the bone, may be the first sign of the disease, as it is not usually characterised by any marked symptoms. The child may even die with symptoms of cerebral compression, when the tuberculous inflammation has been limited to the inner table of the skull, without any suspicion of the true cause of the condition. The treatment, when the disease is recognised, consists in opening the abscess, scraping away any fungating material, and causing it to heal as quickly as possible.

The superior maxilla, the malar, and the lower jaw are the most common seats of tuberculous disease in the *face*. Caries is somewhat more common in these bones than necrosis, and the treatment consists in cutting down upon the affected part and clearing away the softened tissue with a sharp spoon and a rugine. The only complication likely to occur in the case of caries of the superior maxilla is a stillicidium lachrymarum from interference with the nasal duct.

Tuberculous disease of the *ribs*, according to Schmalfuss and Fasbender, in children under fifteen years of age forms 12·5 per cent. of all recorded cases of caries of the ribs. The disease is either primary or it is secondary to an empyema of tuberculous origin, but in either case tuberculous periostitis is more common than a lesion of the bone itself. A chronic abscess is the great sign of the disease. It should be opened, and the diseased ribs should be resected. The *sternum* is occasionally the seat of tuberculous caries, leading to the formation of an abscess which may project into the mediastinum or to sinuses opening externally.

The *clavicle* and the *scapula* are sometimes affected with tubercle, but the disease in these bones is more often

connected with disease of the shoulder and of the sterno-clavicular joints. The bones of the *carpus* and *tarsus* are frequently the seat of tuberculous deposits, but they are in the same way usually associated with tuberculous disease of the joints of which they respectively form a part (pp. 111 and 137).

TUBERCULOUS DACTYLITIS.

Inflammation of the phalanges of the fingers and toes, and of the metacarpal and metatarsal bones, often occurs as a form of simple tuberculous inflammation in children. It usually affects children during the second and third year, but it may occur at any time between the first and the sixteenth year. The metacarpus is more often affected than the neighbouring phalanges, the metatarsus more often than the phalanges of the toes.

Pathology and Morbid Anatomy.—The disease is essentially a tuberculous osteomyelitis, either commencing in the bones themselves, or less frequently, immediately beneath the periosteum. The affected part becomes enlarged, and the bone undergoes a process of rarefaction, which may either terminate in resolution, with or without deformity, or in fungation and suppuration, which may lead to necrosis. The bone is often so thinned and expanded as to leave only a perforated skeleton, thus affording the most perfect examples of rarefaction.

Symptoms.—The patient is often a typically tuberculous child, and the enlargement of the bone comes on as part of a general process. It is painless and uniform, and does not attain a maximum for many weeks. The skin and the overlying tendons are at first free, but they often become involved. The movements of the bone are impaired, the skin is first thin and then yields, so that a depressed sinus

is left with granulations springing from it. A probe passed along the sinus reveals softened or, in rarer cases, dead bone.

Diagnosis.—The diagnosis is not difficult, for the only condition for which it is likely to be mistaken is enchondroma, syphilitic dactylitis, or the results of acute septic osteomyelitis. Enchondroma is harder, has no tendency to suppurate, and runs a more chronic course. Syphilitic dactylitis is much less common than the tuberculous form, occurs in a different type of child, is amenable to anti-syphilitic remedies, and is periosteal rather than endosteal in origin. Septic osteomyelitis runs a different course from the commencement.

Prognosis.—The prognosis is good as regards the local indications, but it is bad as regards the general health of the child, since it usually occurs in connection with other manifestations of tubercle.

Treatment.—The treatment, as is usual in tuberculous disease of bones, consists essentially in rest. The affected part is put upon a splint, after compression has been applied by means of strips of plaster, whilst the health of the child is improved as far as possible. When these means fail, and when fistulæ have formed, the limb should be rendered bloodless, and the sinuses should be enlarged, so that the parts may be thoroughly scraped. Care must be taken to avoid injuring the tendons or their sheaths. The cavity is then dusted with iodoform, and is dressed antiseptically. The disease runs so chronic a course that there is always a little danger of leaving it alone until the mischief is too far advanced to enable operative measures to be of any avail. The best results are obtained by operating as soon as it is clear that rest is useless.

POTT'S DISEASE OF THE SPINE.

Pathology.—Pott's disease of the spine occurs at any age, and in both sexes. It is most frequent in the first decennium, and after the age of two years. It is due to tuberculous changes in the bodies of the vertebræ, the changes usually commencing in the anterior parts of the body close to the lines of the epiphyses, though the posterior portions may also be affected. The tuberculous inflammation leads to rarefying osteitis, with subsequent absorption of more or less of the cancellous tissue, and the eventual fusion of those parts of the vertebral column which are brought into apposition by the curvature necessarily ensuing upon the disappearance of the front of the column. The progress of the disease is usually slow, often taking years to run its course; caseation may then take place with sclerosis. If the infection is mixed, or if the disease runs an acute course, and only lasts months instead of years, necrosis may take place with the formation of extensive abscesses.

Ætiology.—Hoffa states that the tuberculous osteitis usually commences at that part of the spinal column which is most exposed, where movements make the greatest demand upon it, and where the weight of the body is chiefly incident. It is therefore most common, he says, in children in the cervical vertebræ, and in later life in the lumbar region; in the neck the upper vertebræ are more often diseased than the lower. It is most often seen, however, in the dorsal region in my experience. Injury, as in all other surgical manifestations of tubercle, plays an important part in the local production of the disease, but it often follows an attack of scarlet fever, measles, whooping cough, or other disorder which

lowers the vitality of the child, and there is no doubt that it sometimes arises without any known cause.

The **Symptoms** vary according to the particular part of the spinal column affected; as a rule, they are not well marked in the early stages, and they may pass completely unnoticed. The symptoms common to the disease in all parts of the spinal column are rigidity, the result of muscular spasm. The rigidity keeps the spine fixed so that the vertebral movements are very limited in every direction; the child walks and moves stiffly, and turns his body with care. In stooping and in rising, the spine is spared at the expense of the limbs. The diagnosis of the disease in its earlier periods depends greatly upon this muscular rigidity, and the child cannot be considered cured until it has completely disappeared. Pain is an early symptom; it varies greatly in intensity as well as in position. It is elicited by sudden movements of the segments of the spine upon each other, and the patient is therefore careful to keep his muscles in a state of tonic contraction. It is often worse at night, and it wakes the patient as soon as he has fallen asleep.

More marked symptoms appear as the disease progresses. Some amount of lateral curvature may be observed in the vertebral column even before there is any projection of the spine, and this is best seen by viewing the spine as a whole against a dark background. Kyphosis sooner or later becomes apparent, and various compensatory changes then take place in the skeleton. The character of the curve depends upon the number of the vertebræ affected, being sharp when few, and round when many, are diseased. The child stumbles, and becomes more and more disinclined to walk. Chronic abscesses frequently form, more often when the seat of the disease is below than when it is above the level of the diaphragm.

Nervous Symptoms.—The nervous disturbances associated with caries of the spine have recently been studied very carefully at home and abroad, for they have gained in importance owing to the surgical treatment which has been adopted for their relief. They are more common when the laminæ and posterior parts of the bodies are affected, so that they are often present when there is but slight deformity.

The symptoms are due in part to alterations in the nerve roots at the points where they leave the spinal canal, and in part to alterations in the spinal cord itself. They are sometimes due to tuberculous inflammation of the lymphatic tissues about the arteries of the cord; sometimes, but very rarely, to the kyphosis itself, which leads to compression of the cord; sometimes, when the paraplegia comes on suddenly, it is due to fracture of the carious vertebræ, and still more rarely to the bursting of an abscess into the spinal canal, to hæmorrhage into the canal, or to the presence of bony sequestra which, by their displacement, press upon the cord. Most frequently it is due to tuberculous granulation tissue filling up the vertebral canal, and causing by its pressure degenerative changes either in the nerves or in the spinal cord. The area of myelitis in these cases rarely exceeds an inch or an inch and a half in length, but the completeness of the compression is often seen by the readiness with which pulsation returns in the cord as soon as the granulation tissue has been removed in the course of a laminectomy. The various nerve symptoms resulting from compression in cases of spinal caries have been well grouped by Dr. Eskridge, of Denver,[8] from whose lectures the following account is condensed.

The pressure upon and the consequent irritation of the nerve roots leads to an early loss of reflex movements in

the parts supplied by the affected nerves, though in the very earliest stages there is often an exaggerated plantar reflex. The alterations in sensation are usually manifested sooner than the motor symptoms. There is a constant or an intermittent pain which is either dull and aching or sharp and neuralgic in character. It is felt radiating over the back of the head in disease of the upper cervical region, down the arms in the upper dorsal region, round the abdomen in the lower dorsal, and down one or both thighs, along the course of the sciatic nerves, in disease of the lumbo-sacral region. The pain is most often felt in the joints, and they become so extremely sensitive that the slightest touch upon the skin causes great suffering. The nerves are at first unaffected, but after a varying time they become the seat of a descending neuritis which renders them tender, and at the same time prevents them from conducting impulses, so that the patient presents patches of greater or less extent which are anæsthetic when touched, but are the seat of subjective pain. The motor changes come on later, and are characterised by gradual weakening and wasting of the muscles, which may lead to a case of spinal caries being mistaken for progressive muscular atrophy, if the wasting is a more prominent symptom than the bone lesions.

The trophic disturbances usually come on later still, and when the disease occurs in the lower cervical and upper dorsal region there is irregularity of the pupil, with vaso-motor disturbances and sweating. Herpes zoster is only occasionally seen.

When the cord is affected the disease is usually of long standing, and the paralysis is a more prominent and an earlier symptom than the sensory affections. The paralysis is generally bilateral: it may come on slowly, or its onset may be sudden. The bladder is rarely affected in the more

chronic cases, but it is always affected when the paralysis appears suddenly. The anæsthesia may be complete in cases of severe compression ; but the sensory changes, as a rule, are less pronounced than the motor, and in the latest stages of the disease there are often marked ataxic symptoms, even when the paralysis is passing off. The intercostal muscles and the diaphragm are sometimes seriously affected when the spinal cord is compressed in the upper cervical region, so that death may occur directly from the effects of the pressure, or indirectly from any slight pulmonary affection. The reflexes are exaggerated, but bedsores are not formed with undue readiness. When the lumbar enlargement is compressed, the bladder and rectum become paralysed, the knee-jerk is absent, and there is great wasting of the paralysed muscles.

The compression due to tuberculous disease of the spinal column must be distinguished from ordinary myelitis due to inflammation caused by tumours in which the trophic disturbances are generally much better marked, from hæmorrhage into the vertebral canal, and from syringomyelia. The cord is compressed from within outwards in syringo-myelia, whilst in tuberculous disease the pressure is exercised from without inwards. The absence of temperature and pain senses, whilst the tactile sensations remain fairly good, the absence of symptoms due to disease of the bone, or to pressure upon the nerve roots, together with the prolonged duration of the disease, are sufficient to distinguish syringo-myelia from tuberculous compression.

Prognosis.—The prognosis in cases of paraplegia due to pressure is fairly good. The pain remains for a long time, but the other sensory symptoms improve, whilst the disappearance of the paralysis is extremely gradual ; the appearance of cystitis and bedsores necessarily increases the gravity of the prognosis. The chances of complete

recovery are greatest when the dorsal portion of the cord is compressed. The prognosis in these cases is more favourable when absolute paralysis develops rapidly after the appearance of symptoms indicating myelitis than when it appears more gradually, for it is then due to an inflammation of the cord which may subside, rather than to gradual changes within the canal which tend to remain permanent.

The prognosis of spinal caries itself is grave, but by no means bad. Recovery may take place without suppuration, but with anchylosis of one or more vertebræ; or septic infection may lead the patient to the very brink of the grave, and leave him crippled for life. Hoffa gives a mortality of 27 cases in a series of 269, and says that the older the patient the worse is his chance of recovery. Even the paralytic symptoms tend to recover spontaneously if the patient be put under favourable conditions. Myers has shown that 55 per cent. out of a total of 218 cases of paraplegia have completely recovered. The average duration of the paraplegic symptoms, in connection with disease of the cervical spine, was twelve months; in the upper dorsal region, nine and a half months; in the lower dorsal, six months; and in the lumbar, eight months.

The **Differential Diagnosis** of Pott's disease is from rheumatic spine, hysteria, scoliosis, ricketty curvature, typhoidal spine, sacro-iliac and hip disease, torticollis, acute septic osteomyelitis, commencing in the vertebræ; gummatous and sarcomatous infiltration of the bodies, and more rarely from actinomycosis leading to absorption of the vertebrae. It has been carefully considered by Mr. Robert Jones and Dr. Ridlon in the *Provincial Medical Journal* for 1892.

Rheumatic inflammation in children runs a more acute

course than tuberculous, the pain is more diffused and is not increased by pressure, and there is not the same worn facial expression.

Hysteria is recognised by the absence of rigidity and by the character of the pain, light stimuli often being more effective in producing it than heavier ones.

Lateral curvature does not cause rigidity until it has lasted for a long time; the pain is less, the deformity

Fig. 8.—Diagram of a child with spinal caries. It shows that the prominence does not disappear during extension of the vertebral column.
[*From Hoffa's "Lehrbuch der Orthopädischen Chirurgie."*]

of the chest is asymmetrical, and the curve is rather a spiral condition of the vertebral column than a bending of the entire trunk as in Pott's disease.

In ricketty curvature there is an absence of pain, evidence of rickets, and sometimes rigidity. The exact nature of the curve is sometimes to be proved by laying the child flat upon its stomach, and then raising it gently by the ankles so that the back becomes concave. An angular curvature remains, whilst ricketty and lateral

curvatures usually disappear. The following diagrams (figs. 8 and 9) copied from Hoffa show this difference.

The history is sufficient to recognise spinal curvature occurring after typhoid fever, which sometimes causes a chronic osteitis some months after the acute symptoms have passed away, and may leave a life-long deformity.

Sacro-iliac and hip disease are both rather likely to be mistaken for disease of the lumbar spine, and conversely,

FIG. 9.—Diagram of a child with ricketty curvature of the spine. It shows that the prominence disappears during extension of the vertebral column.
[*From Hoffa's "Lehrbuch."*]

especially if a psoas abscess has caused some amount of flexion with fixation of the hip. A rectal examination may clear up a doubtful case of sacro-iliac disease, by demonstrating the presence of inflammatory symptoms in the neighbourhood of the joint; whilst in cases in which it is doubtful whether the hip or spine is affected, a careful examination of the movements at the hip will show that in cases of lumbar caries with an abscess all its movements are free, except extension. A psoas abscess

itself must not be mistaken for a perinephric or other form of chronic abdominal abscess.

Wryneck is closely simulated by caries in the upper cervical region. In wryneck, however, the chin points away from the prominent sterno-mastoid muscle; in caries it points towards that muscle if only one sterno-mastoid be prominent. The movements of the head are restricted in all directions in cervical caries; in torticollis only in one direction—that which puts the shortened muscle on the stretch.

Acute septic osteomyelitis originating in the vertebræ runs a much more acute course, and may affect a very much larger number of vertebræ than does caries. The constitutional symptoms are much more severe.

Syphilitic disease of the spine sometimes occurs at two different points in the vertebræ separated by one or more healthy vertebræ, whilst such healthy intervals less often occur in tuberculous disease. It may co-exist with syphilitic disease of other joints, and it is amenable to the ordinary anti-syphilitic remedies.

It is impossible to distinguish sarcoma of the spine from spinal caries until the progress of the case or the pressure of the tumour clears up the doubt.

Actinomycosis, aneurism of the dorsal aorta, and hydatids of the spine are so rare in England that they do not enter into the question of diagnosis in children.

Characters of Spinal Caries in Different Regions of the Vertebral Column.

It is essential for the proper examination of a case of spinal caries that the patient should be stripped. When cervical caries is suspected, Mr. Jones suggests that the patient should be examined by placing him face downwards upon his parent's knees. If disease exists, the child

will not let his head drop, even though the examination be prolonged, and if he be placed supine he will show no inclination to bend his head towards the sternum in the first act of rising.

Pain may be felt in the chest, or running up the back of the neck and head, or down the arms in caries of the cervical spine. An abscess is not frequent, but when it is present it may point either behind the sterno-mastoid muscle or at the back of the pharynx. It differs anatomically from the retropharyngeal abscess due to suppuration of the glands and connective tissue (p. 25) in the fact that it lies beneath the anterior common ligament.

Dorsal caries is the commonest form of disease. In addition to the ordinary rigidity and difficulty in stooping, the respiration is interfered with, and the child pants. Lateral deviation of the vertebræ, with or without rotation, may precede the angular curvature in this region. An abscess is not very frequent when the upper dorsal vertebræ are affected; but when it appears, it points between the ribs, some little distance outside the spinous processes; a psoas abscess results from disease of the lower dorsal vertebræ. The pain is felt as a girdle pain or stomach-ache.

Lumbar caries is less common than dorsal, but more common than cervical disease. The pain is felt along the front and inner sides of the thigh. One or both psoas muscles may become spasmodically contracted, so that the disease may be mistaken for hip disease, as flexion of the joint occurs before the appearance of any curvature. Mr. Jones gives the following directions for recognising flexion due to spinal disease: "The patient is placed prone upon a table, the pelvis is held firmly down with one hand, while with the other hand first one and then the other knee is lifted upwards. The freedom with which they can be

raised, and the difference in extent of movement, or the extent to which each of them differs from the normal, must be noted. Then, with one hand upon the back, at about the tenth dorsal vertebra, and the other hand lifting up both knees at the same time, the rigidity of that part of the spine is noted. It is upon this rigidity that the diagnosis must depend. In healthy children the spine can be bent backward so far that the thighs are at nearly a right angle with the upper dorsal spine."

Paraplegia is very uncommon in disease of the lumbar spine. Abscess is frequent; it may pass into the psoas muscle, and open in the thigh; or, if the disease is below the third lumbar vertebra, the pus may pass into the sheath of the psoas where it is continuous with the sacral end of the pelvic fascia, so that it tracks down to the pyriformis, and leaves the pelvis by the great sacro-sciatic foramen to point in the buttock. The abscess sometimes extends laterally, following the nerves, and pointing in the loin some inches from the spine. The chronic abscess appears at very variable periods in the disease, sometimes quite early, often soon after the appearance of the spinal deformity, occasionally not until months later; or, if it be a "residual" abscess, not until years after the patient has been cured. The abscess does not necessarily open, for it is no uncommon thing in making a post-mortem examination to find one psoas a mere shell of muscle containing caseating or even calcified material, associated with cured disease of the spine, resulting from simple tuberculous infection. The infection is more frequently mixed, and the abscess then runs an ordinary chronic course, pointing, in the case of a psoas, either externally or internally to the femoral sheath, or else tracking down the thigh for long distances. The projection of the spine is sometimes produced quickly

and continues to alter its shape for a considerable period, whilst at other times it only forms slowly, and hardly undergoes any subsequent change. The amount of deformity too varies greatly; in some rare cases it is hardly perceptible, whilst in others it is so marked that Shaw quotes a case in which the unfortunate patient could only get about "on all-fours."

Treatment. (1) *Palliative.* — The treatment in the earlier stages of the disease is essentially palliative, and exactly the same methods must be adopted for its relief as in other cases of tuberculous osteitis. Rest is therefore a matter of the first importance, and it is essential that the weight of the body should be taken off the

Fig. 10.—Diagram to show the method of applying a plaster-of-Paris case for the treatment of spinal caries.
[*From Hoffa's "Lehrbuch."*]

spine. These indications are met if the patient can be kept absolutely rigid and flat in bed for long periods of time. Mere rest, indeed, will often relieve the pain and lessen the symptoms of paralysis, putting the patient in the fair way towards recovery; but rest alone is insufficient in many cases where the spines of the vertebræ have already become prominent. A moderate amount of extension must then be maintained by moulding a convex splint of plaster-of-Paris, leather, gutta-percha, or in very small children, of poro-plastic felt, to the patient's trunk, as has been recommended by Reeves and Lorenz (fig. 10). A wicker-work tray is often sufficient for better-class patients. The splint should be moulded on to the spine

whilst the child is upon its hands and knees and after the surgeon has gently placed the diseased vertebræ in the position of least deformity. A jury-mast is necessary when the disease is above the eighth dorsal vertebra. A double Thomas may be employed in place of the moulded splint.

When the pain has subsided, when the surgeon considers that there is no longer any tendency to the formation of an abscess, when the child has regained its colour and eats heartily, it need no longer be kept in bed. A rigid jacket made of light material should then be moulded to the spine whilst the vertebral column is in a state of gentle extension, and the patient should be encouraged to take gentle exercise. Whatever material is used for the jacket, it should be well and accurately adapted to the body, reaching from the great trochanters to the axillæ, provided with shoulder straps, and, if necessary, with a jury-mast. A skilfully made plaster-jacket meets the requirements well, if care be taken to keep pressure off all bony points, including the spinal curvature, by pads of felt. As soon as possible the hot and uncomfortable jacket should be replaced by a properly adjusted and light spinal support, which must be worn until the absence of all muscular rigidity in the spine allows it to be laid aside, for only then will complete consolidation have been effected. Some modification of Taylor's support (fig. 11) is often used for this purpose. It consists essentially of two steel uprights, one on either side of the spine, with a cross-piece, straps, and pads.

(2) *Operative.*—Many cases, however, do not run so smooth a course. Abscesses form, the pain continues, the disease progresses, and symptoms of spinal meningitis followed by myelitis occur in spite of absolute physiological rest of the part. Mr. Arbuthnot Lane, Dr. Macewen

and Mr. Thorburn in this country, Dr. Chipault and others abroad, have followed the anti-tuberculous treatment of spinal disease to its logical conclusion by cutting down upon the vertebral column, removing the laminæ over the affected region, and scraping away the granulation tissue which gives rise in the majority of cases to the paraplegic symptoms. This treatment is especially useful when the disease is limited to the posterior part

FIG. 11.—Taylor's brace for supporting the vertebral column in spinal caries after the plaster-jacket has been laid aside.

of the vertebral column; but it is not useful in every case of paraplegia occurring in the course of Pott's disease.

(1) **Indications for Operation.**—Mr. Thorburn says that the indications for the operation of laminectomy are a steady increase in the symptoms, in spite of favourable conditions and treatment; the presence of symptoms which directly threaten life, such as secondary chest troubles and intractable cystitis; the persistence of paraplegic symptoms

after the original pressure lesion has ceased to act, the symptoms being due to pressure caused by scar tissue; and in caries of the posterior part of the spinal column, for in these cases the whole of the tuberculous tissue can easily be removed, and the condition of the patient can thus be materially ameliorated. The operation is also of service when severe pain is rapidly exhausting the patient.

(2) **Contra-Indications.**—Prof. Macewen very properly holds that the operation of laminectomy should not be performed when active tuberculous changes are going on in other organs; in cases of general meningitis, when fracture has followed as a result of caries; and when the symptoms of paraplegia have suddenly manifested themselves.

Laminectomy.

The operation is a strictly logical one if our theories of the pathology of tubercle are correct, and it will probably be found serviceable in some cases. It should not be considered as a matter of frequent necessity, for many cases of paraplegia due to spinal caries, which appear suitable for laminectomy, undergo such marked improvement from rest, with the ordinary methods of treatment, that the operation becomes unnecessary. When it has to be performed, however, it should be done before advanced secondary changes have taken place in the cord, so that the surgeon ought not to wait too long. The theoretical objection attaches to it, that when the uninjured parts are removed by operation and the remaining parts are softened by disease, the use of the spinal column as a support is lost. This argument would be valid in the case of a skeleton; but in the body, if the bone is removed sub-periosteally, the osseous tissue is soon replaced.

The **Technique** of laminectomy is simple. The child is placed upon his left side, an incision is made over the

projecting part of the spine, the soft parts are separated upon the two sides, and with them the periosteum covering the vertebræ, until two or three laminæ are thoroughly exposed. One lamina is then divided with a pair of strong cutting forceps, and is twisted out of place with sequestrum forceps. A sufficient number of laminæ, generally two or three, and if necessary the vertebral spines and the laminæ upon the opposite side, are removed, until the vertebral canal is clearly exposed to view. It is sometimes found to be filled with tuberculous granulation tissue, which must be carefully removed with a sharp spoon, the bleeding being arrested as far as possible, and care being taken that the blood does not pass down into the canal. The spinal cord lies along the anterior surface of the vertebral canal, and at some distance below its posterior arch. It is easily recognised as it lies in its membranes. The spinal cord with its sheath is gently drawn aside by large and broad retractors, until the posterior surface of the bodies of the diseased vertebræ are exposed. The granulation tissue is again scraped away as completely as possible, any abscesses which may be present are opened, the bones are swabbed with a solution of 1 in 15 zinc chloride, and the wound is afterwards well flushed with sterilised water at a temperature of 105° F. The cord is allowed to fall back into place, and the surgeon should not consider that he has done his best for the patient until he sees pulsation in the cord, for he is then sure that every source of constriction has been removed. The soft parts and the skin are brought into accurate apposition, and every endeavour is made to obtain union by first intention, without the use of any drainage-tube. Sensation is restored throughout the body within a few days of the operation, whilst motor power returns more gradually. Fistulous tracts are liable to form at the seat of operation, and recurrence of the symptoms for which

the operation was originally performed has taken place in some of the cases.

The Treatment of Cold Abscesses.

The large cold abscesses which so often occur in connection with tuberculous diseases of the vertebræ and of the hip have long been bugbears to surgeons, and in pre-antiseptic days those surgeons treated their patients best who left such abscesses alone. The abscesses are of two kinds—those containing pus, and those filled with caseous material. The ideal method of treatment for both forms is to dissect them out cleanly without pricking the membrane which surrounds them; but they are often so extensive and so deeply seated that this can only be done in exceptional instances. Dissection is, however, practicable in the case of those caseating collections found in the thigh in connection with cured or stationary disease of the hip; but if it be attempted there must be no hesitation and no mistake upon the part of the surgeon, for the operation must be carried through. If the mass be cleanly removed, the wound will heal by first intention, and good will have been done; if, on the other hand, it be badly removed, and a part be left behind, extensive suppuration is almost sure to follow; for if it be pricked and some of the caseating material be allowed to escape, the wound may become infected, and harm will have been done to the patient, for the scar may become the seat of a tuberculous dermatitis, and it must then be cut out.

Failing the adoption of the ideal method, the surgeon resorts to the next plan, which has been strongly advocated by Mr. Barker, and which is now very generally adopted, with excellent results. The abscess or caseous collection is laid open at its most accessible part, and the contents are allowed to escape. The surgeon then introduces some

form of "flushing-scoop" (fig. 12), which is a sharp spoon provided with a tubular stem, through which a constant stream of fluid can be passed into the hollow of the scoop. The instrument is attached to an irrigator containing a gallon or more of boric solution at a temperature of 105° F., and the irrigator is attached to a pulley running in a block, and is raised and secured at a height of about five feet above the patient as he lies upon the operating table, so that a good head of water may be obtained for the flushing purposes. The scoop is then introduced into the abscess, and its walls are gently but systematically scraped, the fluid being allowed to pass through the scoop either continuously or at intervals. The abscess cavity is thus distended, and its contents as they are loosened by the scoop are carried out of the wound by the reflux stream. The surgeon must exercise care and discretion in using the scoop, for if he is too rough very serious damage may be done to the parts.

FIG. 12.—Dunn's modification of Barker's flushing-scoop. The stem is hollow and the handle movable.

The hot solution serves two purposes besides that of removing the *débris*: it allows of the more ready removal of the contents of the cavity if it be caseous, and at the same time it staunches the bleeding. The cavity is squeezed dry as soon as the whole of the pyogenic membrane has been removed, or the drying is done by introducing pieces of absorbent wool freshly wrung out of a solution of boric acid. The wound is then closed with sutures of horsehair, and is dressed antiseptically. It is better not to use a drainage-tube. This treatment cannot

be carried out to its full extent in many cases of psoas abscess; indeed, it only gives the best results when the bone disease is quiescent and the abscess cavity is simple, and even then it may be necessary to repeat the operation.

The annexed drawings (figs. 13 and 14)—copied from Hoffa—will show how complex these abscesses often are, and that no single operation would be sufficient to cure them. Palliative rather than curative measures must then be tried, or the abscess may be treated piecemeal. I usually open such an abscess, scraping and flushing it as far as it can be reached. A long probe is then passed upwards from the groin into the flank, and afterwards downwards into the thigh. It is made to project beneath the skin in both situations, and counter-openings are made. Drainage-tubes are passed from the counter-openings to the wound in the groin, and antiseptic dressings are applied; but if it is possible the edges of the wounds should be pared and sutured after the abscess cavity has been rendered aseptic. Strict cleanliness is enforced, and little by little the drainage-tubes are shortened, so that the wound in the groin heals first. There is usually no difficulty in getting the wound in the femoral part of the abscess to close, for it is cut off from the source of infection; but it is far different with the iliac part, which is still in connection with diseased bone, and so long as the disease progresses, so long will pus continue to be formed. The after-treatment will now depend upon the individual case; if the abscess be comparatively simple, like that represented in fig. 13, the opening above the crest of the ilium may be enlarged, and valuable information as to the extent of the disease may be obtained by digital exploration, even to the extent of finding a sequestrum, which should be removed if it is possible.

This method is inapplicable when the abscess forms a series of lagoons and canals, like that represented in fig. 14.

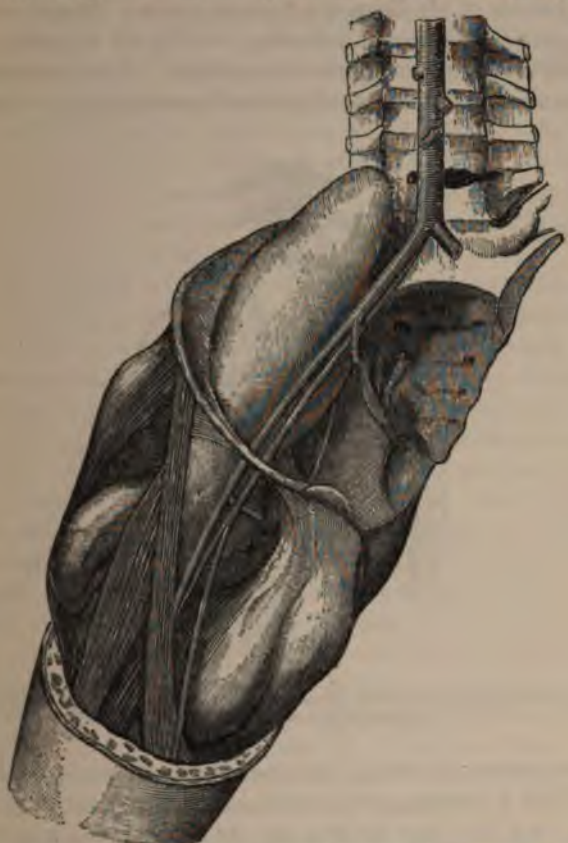

FIG. 13.—A large psoas abscess dissected to show the relations it bears to the various anatomical structures in its neighbourhood.
[*From Hoffa's "Lehrbuch."*]

Two courses are then open to the surgeon. He may cut down upon the diseased vertebræ if he feels pretty sure

that the discharge is kept up by the presence of a sequestrum, and so remove the source of irritation; or if he be less certain of his diagnosis, he may content himself with scraping the sinus and injecting it with an emulsion of iodoform or with camphorated naphthol. The treatment of psoas abscess in this stage is still unsatisfactory. Such

FIG. 14.—Diagram of a double psoas abscess to show its loculated character. [*From Hoffa's "Lehrbuch."*]

improvements, however, have recently been made in our methods of treating these conditions that we need have no fear that we have arrived at the end of our surgical resources, but we may feel assured that in due time a satisfactory cure will be found even for the last stage of a loculated psoas abscess.

HYPERTROPHIC PULMONARY OSTEO-ARTHROPATHY.[9]

Under this very cumbersome title occur certain interesting cases of hypertrophy of the bones and joints.

Pathology.—The hypertrophy may be due to a benign form of tuberculous affection, in which there is no tendency to break down or caseate, caused perhaps by toxines produced during the inflammation. It occurs in children as well as in adults, but very rarely in females.

Symptoms.—The hands and feet are always greatly and symmetrically enlarged, the increase in size involving also the lower part of the forearms and legs, implicating the bones more than the soft parts, and markedly affecting the terminal phalanges, over which the expanded nails are spread out with a transverse and longitudinal curve, so as to be very convex. The nails themselves are large, and bending over the ends of the fingers give them a great resemblance to the beak of a parrot; they are usually striated longitudinally. Various long bones are often hypertrophied, especially at their ends, and effusion of fluid into the knees and other joints is not uncommon The disease in children may be limited to the phalanges. The skull remains unaffected. Scoliosis is common, and it is not rare to meet with kyphosis affecting the lower dorsal region. The disease is generally of insidious onset and long duration; but it sometimes runs a rapid course, and in all or nearly all the cases is accompanied by some form of chronic bronchial, pulmonary, or pleural disease, especially empyema.

Diagnosis.—It has to be distinguished from acromegaly, osteitis deformans and myxœdema. There is no intrinsic danger to life, and the primary and causal condition not

g of necessity fatal, the ultimate result cannot be rved. There is no tendency to acute inflammation or ppuration of the affected bones or joints. Relief of pulmonary condition appears to react beneficially upon complication.

EXPLANATION OF PLATE.

FIG. 1.—A section through the right shoulder joint to show the relation of the synovial membrane to the upper epiphysis of the humerus. The synovial membrane on the inner side comes below the epiphyseal line, but it stops above at the anatomical neck, and is separated from the synovial sheath of the biceps.

FIG. 2.—A vertical section through the elbow joint at the age of eighteen months, showing the lower epiphysis of the humerus, and the upper epiphysis of the ulna, and their relation to the synovial membrane of the elbow joint. (After a drawing made by Mr. Jno. Hutchinson, jun.)

FIG. 3.—Section through the left hip joint to show the relation of the synovial membrane and capsular ligament to the articular surface and to the epiphyses.

FIG. 4.—Section of the left knee to show the relation of the synovial membrane to the articular surface, and to the epiphyses of the femur and tibia.

FIG. 5.—A section through the ankle joint to show the relation of the synovial membranes to the epiphyses and to the astragalus.

(*All the figures are semi-diagrammatic.*)

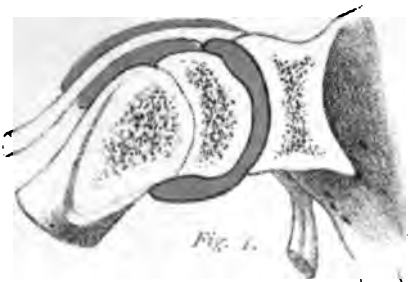

Fig. 1.

Fig. 2.

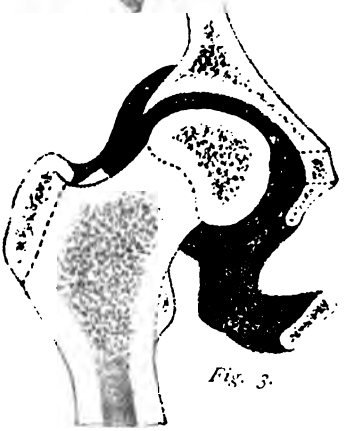

Fig. 3.

Fig. 4.

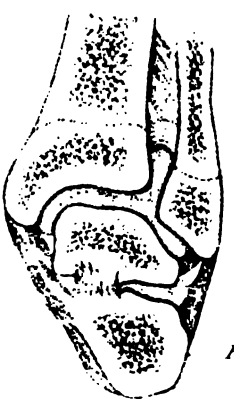

Fig. 5.

SECTIONS OF JOINTS SHOWING THE RELATION OF THE SYNOVIAL MEMBRANES.

CHAPTER VI

TUBERCULOUS DISEASES OF JOINTS AND BURSÆ

Morbid Anatomy.—Tuberculous disease of the joints[7] is very frequent in children. It is most often local, but it may be part of a general tuberculosis. The inflammation commences either in the synovial membrane, or more often in the ossifying tissue of the head of the bone from which the joint becomes secondarily affected by its extension. The frequency with which the joints are affected by this process depends directly upon the anatomical relations of the epiphyseal line to the capsule of the joint—relations which I have endeavoured to make clear in the semi-diagrammatic representations in the coloured plate. It will be seen that the line of the epiphysis in the hip and in the lower end of the humerus is always within the capsule. Tuberculous disease of these joints is therefore frequent, as a result of inflammation of their epiphyses. The capsule is only partially attached to the line of the epiphysis in the shoulder and in the lower end of the femur, so that these joints may escape, although the epiphyseal lines are diseased. This is not often the case, however, as the union between the capsule and the epiphysis is extensive. The capsule of the knee is attached above the upper tibial epiphysis; this joint often escapes, therefore, even when there has been a sharp

ttack of tuberculous inflammation, involving the upper piphyseal line. In the ankle the line of the lower epiphyis of the tibia is external to the capsule, but the astragaus and the lower epiphysis of the fibula are within it. The disease, therefore, usually spreads upwards into the oint from the tarsus, as the lower end of the fibula is not ften the seat of tuberculous inflammation.

The appearances in the joint vary according to the haracter of the disease. When the inflammation comnences in the synovial membrane, there may be a general hickening or, more rarely, a local hypertrophy of its issue. Suppuration takes place in some cases, whilst n others the synovial membrane secretes a clear fluid, vhich distends its cavity and leads to the condition known s hydrops articuli; indeed, all chronic effusions into the oints of children should be regarded with very grave uspicion, for they are nearly always tuberculous. Certain econdary changes take place both outside and within the oint. The thickened synovial fringes may caseate, or hey may become œdematous, and grow over the articuar surfaces, leading to softening of the ligaments and estruction of the cartilages. The connective tissues urrounding the joint either undergo a gelatinous transormation or a fibroid thickening, and in this manner a ypical white swelling is produced. Intra-articular or eri-articular abscesses form, and the joint is destroyed.

The changes in the bone are of the same general characer as those in the synovial membrane. A deposit of ubercle takes place at some part of the epiphyseal line. his either caseates, or fungates, or suppurates, until, in oung children, the inflammation extends through the thin piphysis and sets up an arthritis. The inflammatory roducts in older children may pass into the joint by less irect methods, usually round the edge of the capsule. In

a few cases the joint escapes, but its movements are seriously hampered by the osteophytes formed by the osteoplastic periostitis which the inflammation causes. The cartilages become destroyed, either piecemeal by a process of ulceration, or more rarely by actual necrosis. Granulations spring from the ends of the inflamed bone, and if the patient is under the best possible conditions, bony anchylosis takes place in a good position. Faulty position and fibrous anchylosis is very common in this form of joint disease, or the suppuration is so prolonged and extensive as to lead to death or to a necessity for amputation.

Symptoms.—The individual symptoms will be found described under each joint. The general symptoms common to all forms of tuberculous arthritis are rigidity, swelling, fluctuation, pain, flexion, shortening and displacement. The swelling is a constant symptom of joint disease, and it is seen more early in exposed joints, like the knee and elbow, than in those which are more deeply situated, like the hip and shoulder. The swelling is the result of effusion into the joint, of hypertrophy of the synovial membrane, or to œdema and caseation in the connective tissues outside the joint. The wasting of the muscles above and below the joint always makes it appear to be greater in the knee than it is in reality. This can easily be proved by taking comparative measurements round the two limbs at similar points above, over, and below the affected joint. The fluctuation varies greatly. It is best marked in cases of simple synovial disease, and it is least marked or absent when the swelling is due to extra-articular changes.

The pain is often a characteristic symptom, for it occurs in severe attacks at the instant when the patient falls asleep, and is one cause of the "night-screaming" which

accompanies many of the chronic inflammations in children's joints. The pain appears to be produced by the momentary approximation of the two ends of the inflamed bone, owing to the relaxation of the tonic contraction in which the child keeps its muscles so long as it is conscious. It is therefore usually seen when the cartilages have ulcerated, and it can often be overcome by mechanically separating the inflamed surfaces of the joint with an extension apparatus, but not always, for it appears to be sometimes associated with the changes which precede the formation of an abscess. The pain may also be elicited by movement, and by pressure upon the part.

Flexion is often an important symptom of joint disease, and it is associated with the rigidity of the muscles, which is one of the earliest and most persistent symptoms of a joint lesion. So long as rigidity lasts, so long is there progressive joint disease, and the child should not pass away from the surgeon's care until this symptom has disappeared. The pathology of the muscular rigidity is just beginning to be understood, and it appears to be due to reflex irritation originating in the inflamed articular surfaces, and is part of the general process leading to that atrophy of all the tissues which may result in a shortened limb, even when there has been no absorption or removal of the articular bone. The muscular changes may be so advanced as to lead to a marked fibroid change, rendering them useless. Shortening is partly due to the displacement which often accompanies disease of the joints, and partly to trophic disturbances. The displacement is usually only partial, as in the case of the hip and knee, but it is occasionally a true dislocation.

Diagnosis.—The diagnosis of tuberculous arthritis in children is not difficult; but if the case be seen early, and is at all doubtful, a careful examination should be made

under an anæsthetic to ascertain the exact power of movement which the joint possesses.

Prognosis.—The tendency of tuberculous arthritis is towards destruction of the joint, with subsequent anchylosis of the two surfaces either by bony or fibrous tissue, and often in a bad position. In many cases, however, the patient who is left to nature may die before this process is completed from the effects of the long-continued suppuration attendant upon a mixed tuberculous infection. The inflammatory changes lead to alterations in the growth and the functions of the affected parts, and the surgeon has to guard against these in treating such cases. Relapses and local recurrences are of very frequent occurrence in all cases of tuberculous arthritis.

Treatment.—The recognition of tubercle as a locally infective disease has materially modified the treatment of the tuberculous disease of joints within the last ten years. There existed formerly only excision and amputation; excision dating back at least to the time of Paulus Ægineta, and amputation which is coeval with surgery. The treatment by rest must also have been employed from time immemorial. Increased knowledge has taught us that the tubercle bacillus causes lesions which have in themselves no tendency to suppurate, but rather to undergo caseous changes. The infection in many cases is not simple, but the tubercle bacillus has various septic micro-organisms mixed with it, and these are pus-producing. Still further investigation—but of this we are not so sure—tends to prove that the caseous masses in tubercle are in reality the dead and degenerate remains of the white corpuscles which have been destroyed in an endeavour to limit the spread and the multiplication of the bacilli, the destruction being brought about by the poisonous secretions, or toxins, manufactured for defensive purposes by the micro-organ-

isms. The destruction of the bacilli is thought to be carried out by the great digestive powers with which the white blood corpuscles are endowed. If this be the correct interpretation of the pathology of tubercle, the treatment of tuberculous disease by "*Sclerogeny*" is founded upon the most secure and scientific principles. This method was introduced into surgery by Prof. Lannelongue in 1891. It consists in the injection into the tissues near the tuberculous foci of a solution of zinc chloride. The irritation produced by this reagent leads to an increase in the number, and an alteration in the character, of the white corpuscles in the tissues, which in turn react upon the tuberculous nodules, leading to their destruction. This, at any rate, is the theoretical explanation; the point of surgical interest is that, after such injections, the tuberculous foci sometimes undergo a retrograde process, and become converted into fibrous tissue, which may afterwards be dealt with, if it be necessary, in the ordinary manner.

(1) *Sclerogeny.*—The details of the operation in the case of the knee or shoulder are the following:—The patient is anæsthetised, as the injections are painful, and the part having been thoroughly cleansed in the usual manner, a drachm of zinc chloride solution, of the strength of 1 in 10, is taken up in an aseptic hypodermic syringe. The canula of the syringe is first wiped dry. This is important, as any of the solution remaining on its outside will destroy the skin and tissue in the track of the needle. It is then pushed through the skin and the tissues until its point touches the bone outside the synovial membrane. The point is withdrawn, and four minims of the solution are forced out into the peri-articular connective tissue. The injections are repeated at different points round the joint until about half a drachm of the solution has been used, care being taken in each case that none of the fluid enters

the cavity of the articulation, and also that the injections are made at the parts where the synovial membranes receive their chief blood supply, *i.e.* at the reflection of the synovial membrane on to the bone and along the great ligaments of the joint. When the part to be injected lies superficially, the syringe should be directed obliquely to prevent any reflux of fluid. In no case must an injection be made directly under the skin, and it stands to reason that the large arteries and nerves are to be avoided.

The parts should be firmly bandaged after the operation, to limit, as far as possible, the congestion and œdema; and if there be much pain, a hypodermic injection of morphia must be given. There is usually a pretty sharp reaction, which subsides by the third or fourth day. The limb is put up in a plaster case, and in the most favourable position, as soon as the inflammatory symptoms have subsided. The symptoms of sclerogeny—hardening, and retrogressive changes—are generally well marked in three weeks to two months after the operation, and from this time onwards the muscles should be regularly shampooed and galvanised. A single series of injections is alone necessary in a successful case; but if the operation has to be repeated, an interval of at least three weeks should be allowed to elapse. Prof. Lannelongue claims that in successful cases the results are most satisfactory, whilst in the less successful ones the injections pave the way for further operations of a more radical nature. I am giving the method an extensive trial, but it is too soon to dogmatise upon it.

Many other methods have been adopted to secure the same ends, with a greater or less amount of success. Thus a tincture of iodine, 2 per cent. solution of carbolic acid, a 1 in 4 emulsion of balsam of Peru made up with sweet almonds, a solution of iodoform in glycerine or olive oil, and the liqueur de Villate, consisting of equal parts of zinc sulphate

and copper sulphate, with a little Goulard extract and dilute acetic acid, have at different times been employed. The iodoform emulsion is made according to the following formula :—

℞ Iodoform	10	parts
Glycerine	70	,,
Water	10	,,

Wash the powdered crystalline iodoform in a 1 in 2000 solution of corrosive sublimate, and then rub it up with enough spirit to prevent its becoming lumpy. Shake the iodoform and water together, and then add the glycerine.

Prof. Senn injects the iodoform emulsion directly into the cavity of the joint after removing the synovial fluid or tuberculous pus, and washing out the cavity with a 3–5 per cent. solution of boric acid. He continues the injections at intervals of a week or two, until there is distinct evidence of diminished tuberculous inflammation. The improvement usually manifests itself after the third or fourth injection. I thought a few years ago that I obtained good results after the use of iodoform emulsions in the treatment of tuberculous abscesses; but I believe now that the most satisfactory method is to scrape away all the tuberculous material with a sharp spoon, and endeavour to obtain union by first intention.

(2) *Rest.*—The treatment of tuberculous disease of joints by rest is frequently attended by excellent results in children, due no doubt, in part, to the fact that it allows the tissues time to deal effectively with the tubercle bacillus, and partly because it abolishes the reflex stimulus leading to trophic disturbance. This method of treatment is especially satisfactory in cases where the synovial tissue is alone or chiefly affected. It is only of slight use where the bones are extensively diseased, and where there is much deformity, unless the deformity be due to fibrous bands

which yield to extension. Good as the method is, however, it is liable to abuse if it be adopted too exclusively and for unsuitable cases. The worst cases of lardaceous disease which have recently come under my notice have been those in which the expectant treatment has been conscientiously carried out in patients who had abscesses and sinuses which it was impossible to render aseptic.

Acute abscesses must be opened as soon as possible in a child who has been treated for tuberculous arthritis by rest. The contents of the abscess must be evacuated, and an attempt made to obtain union by first intention; for it should be clearly understood that many of the effects of tuberculous disease are due to the septic rather than to the tuberculous bacilli. Nature, too, in many cases does not give such good results as can be obtained in a shorter time by surgical treatment judiciously applied. Care, therefore, should be taken in the employment of this method. On the one hand, rest should be adopted as a routine proceeding in all cases of incipient joint disease in children; on the other hand, if after its adoption there is not marked improvement, if the disease is progressive, if abscesses form which cannot be effectively dealt with, or if, after sufficient trial, relapses occur as often as the patient is allowed to get about, it should not be persisted in, but recourse should be had to the more radical measures of arthrectomy or excision.

(3) *Operation.*—It is the duty of the surgeon to cut down upon the bone, and to remove any caseating masses when rest, sclerogeny, and the allied methods have failed. He must operate at once when he suspects that a tuberculous focus is present in the epiphyseal line. He is especially bound to do this when the disease affects the posterior part of the head of the humerus, the upper or lower epiphyses of the tibia, the popliteal surface of the femur, and

the upper part of this bone, particularly when the great trochanter is alone involved. The operation should be performed upon a limb which has been rendered bloodless by the application of an Esmarch's bandage. The bone should be exposed, and should be gouged away in the neighbourhood of the epiphysis. When the diseased tissue is exposed, it should be removed, and the cavity in which it lay should be swabbed out with a 1 in 15 solution of zinc chloride. It should be thoroughly flushed with boiled water, packed with gauze, and allowed to granulate. I have recently been trying the effect of packing such tuberculous cavities and sinuses with camphorated naphthol, taking care never to introduce more than four drachms at a time, lest poisonous symptoms should result. The directions for making the preparation will be found on page 8. The results are, I think, a little better than those obtained from packing with cyanide gauze.

Sterno-Clavicular Joint.

Frequency. — Inflammation of the sterno-clavicular joint [10] is one of the rarest forms of tuberculous arthritis. It may occur in young adults, but there is no case on record in which it has been seen in infants It is either primary, when it commences as a synovitis, or it is secondary to tuberculous caries of the clavicle.

Symptoms.—Pain is the earliest symptom of the disease, and it is of such a nature as to compel the patient to assume the position which is thought to be characteristic of a broken collar-bone. He supports his bent elbow in his hand to take off the weight of the arm, and inclines his head to the affected side to relax the tension of the muscles. Sooner or later, a swelling appears over the sterno-clavicular end of the joint, and it is a typical tumor albus. It is oval in shape, with its long axis lying parallel

with the clavicle. The skin is distended over it, but it is unaltered in character, except that it is traversed by a few veins which are rather more conspicuous than usual. It feels doughy. The temperature is not warmer than the surrounding parts. Careful examination will show that it projects behind the articulation as well as in front of it, and in this stage it is likely to be mistaken for a sarcoma. It eventually suppurates, and leads to sinuses in the thoracic wall. The sternal end of the clavicle may be displaced, and in some rare cases the abscess has been known to point and open into the mediastinum or into the pleura, or it may even lead to ulceration of the great venous trunks lying in its immediate neighbourhood.

The **Treatment** consists in cutting down upon the swelling, removing all the fungating tissue, and sterilising the cavity as far as possible, so as to enable it to heal by healthy granulations.

Tuberculous Disease of the Shoulder.

Frequency and Course.—The shoulder is less frequently affected than the other large joints, for it only forms 25 per cent. of the total number of joint cases in children. The tubercle may be deposited in the synovial membrane, or rather more often in the cancellous tissue of the bones themselves, as "caries sicca" is not unusual in the head of the humerus. Suppuration takes place, and the abscess tracks downwards along the biceps tendon, or opens into the bursa beneath the deltoid. More rarely it appears in the axilla, or it may point behind in the supra-spinatus or infra-spinatus fossa. In some very interesting cases, known as *caries sicca*, the disease runs its whole course without marked symptoms and without suppuration, so that complete bony anchylosis of the shoulder may take place in a child who hardly appears to

have been ill. A similar quiet anchylosis takes place in other joints, especially in the elbow, knee, and ankle. This form of anchylosis is usually attributed to tuberculous or rheumatic processes; but we are quite ignorant of its true pathology, and it requires much more careful observation than has yet been bestowed upon it.

The **Symptoms** in an ordinary case of tuberculous disease of the shoulder are loss of function in the joint, with internal rotation and adduction of the arm. Pain is not usually a very marked feature.

The **Prognosis** is good, for a useful limb results in the majority of cases.

Treatment.—Rest is best obtained by the application of a plaster-of-Paris bandage, after a pad has been put into the axilla to produce a certain amount of abduction. An atypical excision may sometimes be required when the sinuses are persistent, but such an operation is not of frequent occurrence. A formal excision of the joint is best performed with the arm extended and rotated outwards, through an incision carried just external to the coracoid process longitudinally downwards, so as to expose the long head of the biceps lying in the bicipital groove. The fibres of the deltoid are held back by broad retractors, and the capsule of the joint is laid open. Its cavity is thoroughly explored, and the diseased tissue is removed as far as may be necessary, either by scraping it away or by sawing through the head of the bone, either at the anatomical neck, through the tuberosities, or at the surgical neck. The whole of the diseased tissue is removed with dissecting forceps and scissors, the cavity of the joint is swabbed out with a 1 in 15 solution of zinc chloride and flushed, and the sinuses are treated in a similar manner. The parts are then brought together, and every endeavour is made to obtain union by first intention. Passive move-

ment should be commenced within the first fortnight, as a movable joint is required. The results in children are not so good as in adults.

Elbow.

Frequency.—Tuberculous disease of the elbow is very common, as it forms 50 per cent. of all cases of joint disease in children. It nearly always begins in the bones.

Symptoms.—It commences insidiously, for the pain and functional disturbance are not marked symptoms until the disease is well advanced. The swelling is first noticed at the back of the joint, but it soon extends all round, and the typical oval tumour is developed, which has led to the use of the term "tumor albus" as a synonym for tuberculous arthritis. Pronation and supination are not materially affected, though complete extension soon becomes impossible. Secondary dislocations are rare, but anchylosis is not at all an infrequent result.

Treatment.—Complete rest until all inflammatory symptoms have passed away is the first treatment to be adopted in these cases. The elbow should be bent to a right angle and should be secured in a plaster-of-Paris case, or in a well-fitting leather splint applied along the back of the joint. An arthrectomy must be performed when sinuses form in spite of this treatment. Mr. Clutton has recently advocated and adopted this operation with great success. He prefers, however, to do it quite at an early period, and before suppuration has taken place; for he aims at securing a movable joint without having recourse to passive movement. His method of operating is as follows:—

Arthrectomy.—The skin is thoroughly cleansed with soft soap or liquor potassæ. A transverse incision is made across the base of the olecranon, which is then divided with a saw. The olecranon is drawn upwards, and the

fascial expansion is divided until the joint can be so freely opened as to allow all its parts to be efficiently scraped. All the granulation tissue is then removed with forceps and scissors, special attention being paid to the various pockets in the synovial membrane. Pieces of loose cartilage are scraped away with a sharp spoon, and the soft and carious bone is gouged out, the whole of the exposed surface being repeatedly flushed with a solution of 1 in 5000 perchloride of mercury, at a temperature of 100° F. The most difficult part of the operation consists in clearing the part of the joint beneath the brachialis anticus.

The olecranon is attached to the ulna, by means of a wire or an aseptic silk suture, as soon as the diseased tissues have been removed. The edges of the skin incision are brought together accurately with sutures, and an antiseptic dressing is applied, with the arm at a right angle. A narrow strip of plaster-of-Paris bandage is applied to the front of the arm, and in favourable cases the dressings are not removed for two or three weeks. When the temperature rises the wound must be dressed, and it may be necessary to separate its edges with a director to allow any retained secretion to escape. The plaster-of-Paris splint is applied to the back of the joint as soon as the wound has healed; it is worn until all tenderness has disappeared—usually for two or three months—and the patient is then allowed to use the arm freely. In many cases Mr. Clutton has obtained excellent results; in some, anchylosis has resulted; in others, the persistence of suppuration has obliged him to have recourse to excision of the joint.

Excision.—A formal excision is best performed by rendering the arm bloodless with an Esmarch's bandage, bending the elbow, and then carrying a vertical incision along the back of the joint and a little to the inner side

of the middle of the olecranon. The incision should measure three inches in length, and the anconeus should be injured as little as possible in order to secure the power of extension. Care must also be taken to injure neither the triceps, its aponeurosis, nor the lateral ligaments. The condyles of the humerus are cleaned, and the bone is sawn through on a level with their base, whilst the heads of the radius and ulna are made to project, and are then sawn off together above the attachment of the brachialis anticus. The synovial membrane must be thoroughly removed, especially from the upper part of the olecranon fossa, where large masses of granulation tissue are apt to be overlooked. The wound is flushed, closed and dressed in the same manner as after an arthrectomy. The child is anæsthetised about the tenth day, and gentle passive movements of the elbow should then be commenced. They must be repeated daily by the surgeon, who fixes the arm and gently pronates and supinates the forearm.

The results of excision of the elbow are satisfactory, though it is not often necessary to perform the operation.

Wrist.

Tuberculous disease of the wrist is rare in young children, but it becomes a little more frequent as age advances.

Symptoms.—It is a chronic and very insidious affection, usually commencing in the bones themselves, and generally involving the whole of the carpus. The wrist is full and smooth in outline both on the dorsal and palmar aspects. There is a little difficulty in extending it, and the hand is not used so freely as its fellow. Sinuses are formed sooner or later, and if these be probed there can be no doubt as to the presence of caseous and carious bone. The tendons and their sheaths are often involved in the

tuberculous process. I have occasionally seen cases in which the carpal bones have undergone necrosis, apparently due to the disease having begun as a tuberculous synovitis; but such a form is much less common in children than tuberculous caries commencing in the bones themselves.

Treatment.—The treatment in the early cases consists of rest both of the wrist and hand. Atypical excision must be performed in the later stages, and as much of the fungating tissue as possible should be removed by enlarging the sinuses. A free application of zinc chloride should then be made. The results are not, as a rule, very satisfactory; but Mr. Eve recently showed a case in which the patient could play the piano after undergoing an excision of the wrist.

Sacro-iliac Disease.

Sacro-iliac disease[11] may be mistaken for tuberculous disease of the hip in its earlier stages, but it so rare in children that it need hardly be taken into account. The affection may be confined to the sacro-iliac joint, or it may be part of a general tuberculous infection. It runs a very slow course.

Symptoms.—The patient limps, and the pain is often much more severe than in disease of the hip. The buttock atrophies early, and there is evidence of swelling over the joint. The pain is relieved when the patient is in bed, but it is increased by movement, by pressing the iliac bones inwards, and by deep pressure over the joint. Abscesses are formed which pass through the anterior ligament and open beneath the glutæus maximus into the psoas, or iliacus, or more rarely into the rectum. They sometimes track along the multifidus spinæ, and point either in the lumbar region or directly over the joint.

Diagnosis.—The movements of the hip are free, and a

careful examination may reveal a little thickening or swelling over the affected joint. The surgeon should assure himself that the symptoms are not due to tuberculous disease of the lumbar spine.

Prognosis.—The prognosis is less favourable than in hip disease or lumbar caries. It is better when the posterior part of the articulation is affected than when the carious process involves the front of the joint, for it then extends to the sacrum, and leads to the formation of abscesses within the pelvis.

Treatment.—The treatment consists in keeping the patient absolutely at rest in bed, with a weight and extension apparatus (p. 117) upon the leg of the affected side, until the more acute symptoms have passed off. The pain can sometimes be relieved by the application of a Paquelin's cautery over the affected joint, but counter-irritation must not be applied when abscesses have formed. As soon as the acute symptoms have subsided, the patient should be allowed to go into the fresh air, after a double Thomas' splint has been applied; but every night the splint should be taken off and the extension reapplied. The splint reaches from the axilla to just above the knee, and is provided with a broad band passing round the body at the level of the sacro-iliac joint. It should have shoulder straps. A leather splint moulded to the pelvis may be employed in place of the Thomas'; but in either case a boot and patten should be put upon the sound leg, and crutches should be used.

Operative measures must be adopted as soon as there is evidence of suppuration.

Hip.

Frequency.—Tuberculous disease of the hip is said to form 37 per cent. of all the cases of joint disease in

children. Riedel has recently shown that 84 per cent. of the cases begin in the bone, and that only 16 per cent. are synovial in origin.

Course.—Sequestra are much more common in cases of hip disease than in any other joint. The infection is usually mixed so that cold abscesses are formed early, the capsule of the joint is destroyed, and displacement of the head of the femur is frequent, though true dislocation is rare (see p. 120). Remarkable trophic disturbances are seen in connection with the large muscles of the gluteal region. The exact cause of their wasting is a matter of dispute, though there is reason to suppose that it may be reflex in origin and that it is not due simply to disease or to flexion of the thigh.

Symptoms.—The symptoms, as in other cases of tuberculous arthritis, are ill-defined in the early stages. The first noticeable symptom is limping, either with or without pain. The limping is due to the abduction of the thigh, external rotation, and to the flexion in which it is maintained by the tonic contraction of the surrounding muscles; for if the child be anæsthetised during this stage the movements at the hip are found to be quite free. Pain felt either in the knee, or referred to the hip, with or without exacerbations at night, is a frequent symptom at this stage. The pain is usually, and I think correctly, assumed to be due to stimulation of one of the articular twigs of the obturator nerve, running along the ligamentum teres; but some surgeons hold that it is an impression conducted along the centre of the bone from the inflamed medulla.

The flexed and abducted position of the limb leads to certain compensatory changes to enable the patient to maintain his equilibrium. Lordosis and some amount of lateral curvature are the most marked, and as a result of these changes the limb on the affected side seems to be

longer than it is upon the sound side, so long as it is kept in a state of abduction, though if it be adducted it seems to be shorter. It is important, therefore, actually to measure an affected limb, to ascertain that lengthening or shortening does not really exist, or else to observe that the two anterior superior spines of the ilium are not upon the same level. Swelling in the neighbourhood of the joint is an early symptom of the disease. It is often most obvious behind the greater trochanter, or it may be noticed that the pulsation in the femoral artery is more superficial and easier to feel in the groin on the affected side. A rectal examination, in some obscure cases where the disease has begun in the acetabulum, may reveal the presence of a painful swelling in the affected ilium.

Differential Diagnosis.—The recognition of hip disease is not always easy, for it has to be distinguished from hysteria, from spinal caries, from simple neuralgia of the joint, as well as from sacro-iliac disease.

Hysterical disease of the hip usually comes on suddenly after a slight injury. It lasts for very long periods of time without producing any of the objective symptoms characterising active disease. The pain is more violent than in tuberculous disease, and it may be elicited by light cutaneous stimuli, which would be quite ineffectual in true disease. The hysterical symptoms may cease as abruptly as they commenced. Osteomyelitis of the femur or acetabulum runs a more rapid course than tuberculous disease; but all infective forms of inflammation, as well as that which is due to syphilis, have to be taken into account in making a diagnosis.

Treatment.—Rest and extension will often cure a patient in the earlier stages of the disease, even when some amount of suppuration has taken place. Dr. Sayre says that patients who have been perfectly cured of hip

disease should be able to flex the thigh to an acute angle, and cross the foot over the opposite thigh. The crossing of the foot he considers a crucial test, for it is a very difficult movement for a patient to execute if there is the least rigidity about the hip-joint. He says that if an imperfectly cured patient be watched as he puts on his boots and laces them, he will nearly always stand and put his foot out to one side; whilst a person who has perfect freedom of movement at his hip, sits and crosses his foot over the opposite thigh.

Treatment by Extension.—The method of applying extension is shown in fig. 15. It is as follows:—The leg is carefully washed and thoroughly dried. A piece of stout strapping, 2 inches in width and 28, 32, or 36 inches in length, is obtained and doubled; into its centre is secured a square piece of wood called the stirrup. The strapping is warmed, and applied to either side of the leg, care being taken that it extends an inch or two above the knee (fig. 15 B). The two longitudinal pieces of strapping are kept in place by winding a second piece of strapping over them and spirally up the leg. A light roller bandage, not shown in the figure, is placed over the strapping to keep it secure. A cord is then passed through the centre of the stirrup and is allowed to run over a pulley fixed to the bed, a weight of varying amount being attached to the end of the cord. This weight should be sufficient to overcome the starting pains at night in an ordinary case, and the limb must be extended at first in its faulty axis. It is usually two pounds for a child of two years old, and increases half a pound for each additional year. The foot of the bed may be raised upon two wooden blocks three or four inches in height. The cot is provided with a firm mattress, and the child is prevented from raising itself into a sitting position by a band of webbing, provided with

FIG. 15.—The treatment of tuberculous disease of the hip by extension.

loops to pass round its shoulders (fig. 15 D), the ends being secured under the bed (fig. 15 E). It is often necessary to

keep the pelvis level in a restless child by applying a long Liston's splint upon the sound side. The extension must be capable of alterations in height and in angle to enable the lordosis to be entirely overcome, and it should be a routine part of the surgeon's business to pass his hand under the lumbar spine of the patient, as often as he sees him, to assure himself that it is flat (fig. 15 C) upon the bed. The lordosis, which is at first extensive, can nearly always be overcome by continued extension, the hip being at first flexed to the full extent necessary to overcome the lumbar arch by the use of a graduated series of wedge-shaped pillows under the leg (fig. 15 A). The pulley should then be lowered daily, and gradually, until the two legs are absolutely parallel.

The amount of lordosis is of great importance in the treatment of hip disease by extension, for it is a measure of the flexion of the hip; but it is too often overlooked in a patient who has been confined to his bed for a long time, and the surgeon should therefore constantly assure himself that it does not exist, by passing his hand from time to time under the loins, and ascertaining that the body lies flat upon the bed. The leg must be raised if the loin is arched; but when anchylosis is unavoidable, a slight amount of flexion at the hip may render the limb more serviceable than one which is absolutely straight. It is very important, too, in cases treated by prolonged rest with extension, that the limb should not be allowed to become adducted.

The treatment by weight extension must be maintained for many weeks or months, until all symptoms of muscular rigidity have passed away, and until the joint has resumed its original freedom of movement. This takes place in a certain proportion of cases, and the result of the treatment is then perfect.

Symptoms and Treatment of Abscesses. — Abscesses form in a large number of cases, even though the joint has been maintained at absolute rest, and this must of necessity take place in all cases where there is a mixed infection. The abscess is usually deeply situated near the joint, and it often requires great skill to detect its presence at an early period, for the sense of deep fluctuation is often very obscure. An increase in "night screaming" when the pain is not relieved by increasing the weight of the extending force, is often one of the earliest symptoms of the formation of such an abscess. The pain in these cases is sometimes relieved by the administration of five-grain doses of sodium, or potassium bromide, with the local application of hot fomentations of boric acid or of belladonna.

All abscesses must be opened and rendered aseptic as soon as they are recognised; sequestra should be removed, and if they cannot be made to heal by first intention they must be drained. The abscesses usually point either in Scarpa's triangle; on the inner side of the thigh; below the anterior superior spine, between the tensor fasciæ femoris and the sartorius; just above the insertion of the psoas muscle, or beneath the glutei behind. In some cases they pass into the pelvis and may open above Poupart's ligament, or they may even open into the rectum or bladder. They should never be allowed to attain any large size, or to open spontaneously, as they infect the various tissues with which they come into contact. Their contents vary greatly, from ordinary pus to a mass of mortar-like material, consisting of caseating products of the tuberculous inflammation.

Sequelæ.—Displacement of the femur upwards occurs in neglected cases, and sometimes in spite of every care. The leg then becomes shortened, inverted, and the trochanter on the affected side is placed above Nélaton's line.

The shortening is partly due to a change in position of the head, and partly due to trophic changes in the bone itself. A true dislocation sometimes takes place suddenly and quite early in the disease, but the displacement is more usually gradual, and is the result of the absorption of the head of the femur, and the enlargement of the acetabulum upwards and backwards. Mr. Holmes has shown that true dislocation, in which the head of the femur leaves the acetabulum, is a rare result of hip disease, and that the ordinary appearances are due to the head of the bone being drawn upwards by muscular action so as to bring the trochanter into a relatively higher position. The integrity or destruction of the capsule will determine the exact position of the bone.

The displacement is disastrous, on account of the shortening which it produces, and it must be prevented as far as possible by careful extension, so that when anchylosis takes place the upper end of the femur may still bear a direct relation to the lower part of the altered acetabulum. The tendency to inversion and adduction of the thigh must also be overcome. Anchylosis in a good position is the best that can be hoped for in these cases; but perfect movement in the hip may be obtained after the formation of abscesses, and even when sinuses have remained open for some time.

Duration.—The affection usually takes months or years to run its course, but in a minority of cases the disease is acute, dislocation takes place early, there is very great pain, and death takes place from some other tuberculous lesion; in fact, the disease of the hip is only part of a general tuberculosis.

Treatment. (1) *Palliative.*—The treatment in the chronic forms is to keep the patient in a horizontal position until the muscular rigidity has become markedly lessened, or

until abscesses are no longer formed, and there is evidence that firm anchylosis has taken place. He is then ordered to wear a Thomas' hip-splint, a patten is put upon the boot of the sound leg, and he is taught to walk upon crutches until all symptoms of disease have passed away. He should be examined, however, from time to time to see that the disease is quiescent. As soon as the disease is cured, the patient is provided with a boot whose sole is thick enough to make up for the shortening of the affected leg; or, when it is important to conceal the deformity as much as possible, an O'Connor extension apparatus may be employed on great occasions, for its permanent use is inadvisable. It is surprising to notice how little discomfort is experienced by a young patient, even when one hip is completely anchylosed.

(2) *Operative Treatment: Primary.*—Excision of the hip is performed when the disease progresses in spite of adequate treatment by rest, when sequestra are present within the capsule, and when there is reason to suppose that the head of the bone is dead, though this is more often the result of acute osteomyelitis than of tuberculous disease. The operation is generally done somewhat earlier than in similar disease of other joints; and, ideally, it should be performed whilst the disease is confined to the joint, and has not yet invaded the surrounding parts. It has the great disadvantage that the upper epiphysis of the femur lies within the capsule of the joint, and must therefore be removed, so that shortening of necessity follows the operation.

The patient is prepared in the usual manner for excision of a joint, and any large abscesses having been thoroughly scraped and cleansed, an incision is carried downwards and a little inwards, commencing just below the anterior superior spine of the ilium, and terminating three inches

lower down, so that it passes between the tensor fasciæ femoris on the outer side, and the outer border of the sartorius upon the inner side. This incision is carried straight down to the bone, and in many cases it will be found possible to utilise the sinus communicating with the abscess, which usually lies beneath the sartorius and the tensor fasciæ femoris, to enable the surgeon to reach the joint. The soft parts are retracted, and a finger is introduced to feel the capsule and to ascertain the condition of the joint. Sequestra are removed with forceps, or if the head is so carious and ulcerated that it be deemed unwise to leave it, the great trochanter is sawn through obliquely downwards and forwards with a narrow-bladed saw, and it is removed. Mr. Pollard prefers to saw through the neck of the bone only, and he takes care not to divide more of the Y-ligament than is absolutely necessary; for it is one of the chief agents in limiting the subsequent displacement of the femur upwards. It is sometimes even necessary to saw through the femur below the trochanter; but this is only done in cases of very extensive disease of the neck of the femur.

After the head of the bone has been removed, the acetabulum is carefully examined with the finger to ascertain what carious patches it may contain; and these, with as much of the fungating tissue as can be reached, are removed with a flushing scoop. The cavity is then swabbed out with a solution of zinc chloride, thoroughly irrigated with sterilised water at the temperature of the body, dried, and as soon as the bleeding has been completely arrested, the wound is sewn up without any drainage-tube. Antiseptic dressings are applied, and the requisite rigidity of the joint is obtained by means of a plaster-of-Paris case, shaped like a pair of women's drawers, or by a double Thomas' splint, so modified as to maintain the limb in slight abduction.

Mr. Barker, who has done much to perfect the technique of the operation in England, points out that the best results are obtained when union occurs by first intention, and this can only be ensured when the operation is performed before the sinuses have formed. If, however, sinuses are present at the time of the operation, they must be thoroughly scraped and rendered as aseptic as possible. They may sometimes be utilised as the lines of incision when they are of considerable size.

The hip does not lend itself readily to arthrectomy; but atypical operations, or operations which are not carried out upon the formal lines described in text-books, are often necessary. These operations are performed to relieve symptoms as they arise, by removing such sequestra and pieces of diseased bone or tissue as may from time to time be discovered. Secondary operations are required nearly as often after excision of the hip as after excision of the knee. Indeed, it very rarely happens in either joint that a single operation is sufficient to secure the absolute removal of all the diseased tissue.

Secondary Operations. — Operative measures are required when anchylosis of the hip has taken place in a faulty position. Flexion and adduction of the joint lead to the most serious interference with its functions. Tenotomy and myotomy must be performed if the contraction be of muscular origin. The sartorius, tensor fasciæ femoris, glutæus medius, rectus and ilio-psoas muscles most often require division. The adductors, too, may be divided, taking care not to injure the femoral vessels.

Forcible straightening under an anæsthetic, after all the active symptoms of the disease have passed away, is sufficient to overcome a fibrous anchylosis; but the method must be used with care, as great and permanent injury may be done to the joint.

A sub-trochanteric osteotomy must be performed when there is bony anchylosis. An incision is made just below the great trochanter, and upon its outer aspect. An Adams' saw is passed along the knife, which is then withdrawn, and the bone is sawn from without inwards until its division can be completed by fracturing the compact tissue on its inner aspect. The section must be made at right angles to the long axis of the femur, and without any reference to the pelvis. It is generally necessary to divide some of the tendons surrounding the hip before the joint can be completely straightened. The wounds are dressed antiseptically, and heal by first intention. The limb is put up in its corrected position, and a long Liston's splint or plaster-of-Paris drawers are applied for a month, care being taken during the whole time that the leg and thigh are maintained in slight abduction.

Amputation at the hip-joint still has to be performed occasionally to save the life of a patient suffering from morbus coxæ. It is required when excision has failed; when profuse suppuration threatens life; when lardaceous disease manifests itself in the form of diarrhœa and albuminuria; when there is evidence of progressive tuberculous disease in other organs; in some very acute cases, attended with extreme pain, and when there is evidence that the disease has extended from the acetabulum into the pelvis.

The thigh is readily and almost bloodlessly removed by Furneaux-Jordan's method. A simple circular incision is made down to the bone at the apex of Scarpa's triangle (digital compression of the femoral artery being made by an assistant), the femur is sawn through, and the main arteries are picked up and tied as quickly as possible. A straight incision down to the bone is then made along the outer side of the thigh, commencing at the top of the

great trochanter, and terminating at the cut end of the stump. The soft tissues, including the periosteum, are then stripped off the femur, and the head of the bone is disarticulated. This part of the operation is perfectly easy in a child, for the softened tissues are easily stripped off, and the head of the bone has often disappeared, either wholly or in part. The periosteum, acetabulum, and the sinuses are examined, if the condition of the patient permits, and all the granulation tissue is removed with a sharp spoon. The muscles retract so much into the acetabulum that it is unnecessary to form any skin-flap, for the edges of the wound come together nicely. A drainage-tube is inserted, sutures are introduced, and a good sound stump usually results. When it is important to lose as little blood as possible, the outer incision should be made first, the head of the femur disarticulated, the soft parts freed from the bone; the circular incision dividing the femoral artery then completes the operation.

Double Disease of the Hip.

Tuberculous disease of both hips is not of very frequent occurrence. Dr. Ridlon, who has had opportunities of observing such cases, says that it rarely begins simultaneously in both joints. The second hip may become affected whilst the patient is confined to bed, so that it is clearly not due to injury. The joint first affected is often the last to recover, so that the disease runs a more rapid course in the joint secondarily affected.

Treatment.—The treatment does not differ from that of the ordinary form of morbus coxæ. The patient is put to bed with a weight and extension until the acute symptoms have passed away. He is then allowed to go about in a well-fitting double Thomas' splint. The result is not unfavourable; complete recovery may take place, but double

anchylosis, with more or less adduction, is the commoner result.

Knee.

Frequency.—Tuberculous disease of the knee ranks next in frequency to morbus coxæ, for it occurs in 30·7 per cent. of all the joint diseases in children.

Pathology.—The disease commences more frequently as a synovitis than in other cases, though foci of inflammation in the bone are by no means uncommon, either in the ends of the bone, within the capsule of the joint, or in those parts which are extra-articular. The tuberculous synovitis assumes two forms in the knee—one, a simple and chronic form leading to hydrops articuli, which is rare, and the other a fungating variety, which is common. The infiltration usually begins at the point where the synovial membrane blends with the periosteum, or with the articular cartilage. The synovial membrane and its fringes become thickened, and the inflammatory products either caseate or suppurate. Large abscesses are thus formed in the joint, or its cavity may be so much obliterated by the tuberculous thickening as to allow of the formation of local abscesses. When the bones are primarily involved, and in very chronic cases, radical changes take place in the condyles of the femur and in the head of the tibia. Flexion results with backward displacement and external rotation of the tibia, giving rise to the characteristic "triple displacement."

Symptoms.—The disease commences in children between three and six years of age, though I have under my care at the present time a well-marked case of white swelling of the knee in a child aged eleven months. It is usually attributed to an injury. The child limps, because his knee is bent; but he does not, as a rule, complain of pain in

the earlier stages. Examination shows that the joint is warmer than its fellow, and than the limb above and below it. The outlines of the joint, especially upon either side of the ligamentum patellæ, are fuller than they should be, so that there is a diminution in the natural dimples. The limb above and below the joint is wasted. There is some fluctuation in the joint, but not much. In cases of hydrops articuli, however, fluid collects in the joint in considerable quantities, but its functions are hardly interfered with for years. In the ordinary pulpy degeneration of the synovial membrane, the outline of the knee soon becomes oval, and all evidence of the thickened synovial membrane is lost to sight, owing to the œdematous condition of the peri-articular connective tissues, though the increased resistance which it offers can still be felt. Anchylosis, with the limb in a state of triple displacement—flexion, external rotation and backward displacement of the tibia—takes place in simple infection, as well as when the joint has suppurated.

Diagnosis.—Tuberculous disease of the knee may be mistaken for rheumatic or syphilitic arthritis, or for osteomyelitis; and, conversely, an ossifying sarcoma of the lower end of the femur may be mistaken for a case of tuberculous disease, though the infiltration of the glands in the groin will soon render the true nature of the case conspicuous. Gonorrhœal arthritis also occurs in children, but it is very rare, and there is evidence of a purulent discharge either from the eyes or the genitals.

Treatment. (1) *Palliative.*—The treatment of tuberculous inflammation of the knee consists in keeping the joint extended and at rest, indications which are best met by the application of a plaster-of-Paris case, by a Thomas' knee-splint, or by a properly moulded leather splint. Thomas' splint (fig. 16), with extension, is ap-

plied in the following manner:—A splint is selected which reaches from the groin to four inches below the instep. The oblique ring at the top of the splint is slipped up the thigh until it lies comfortably in the groin, the child being recumbent. An extension apparatus, similar to that used in the treatment of hip disease, is then applied to the leg. Four strips of strapping, two inches wide, and long enough to go twice round the thickest part of the limb, are then

Fig. 16.—Back view of a boy wearing a Thomas' knee-splint applied in the manner described in the text.

cut—two for the thigh, and two for the leg. One end of the first piece of strapping is secured round the upper part of the thigh, and is passed from without inwards round the outside of the splint. The second strip is secured round the lower part of the thigh in an opposite direction, for it is passed round the borders of the splint from within outwards, so that the thigh is slung and fixed immovably

between the two parallel borders of the splint. The thigh being fixed, the knee is straightened, and the extension is maintained by tying tapes from the stirrup to either side of the splint below the cross-bar. The leg is then fixed in a manner similar to the thigh, by passing two strips of strapping in opposite directions. A roller bandage—not shown in the figure—is finally applied from the foot, which should be kept at right angles, as high as the middle of the thigh. The patient is then provided with a patten for the sound foot, and is allowed to go about upon crutches. Anchylosis with the knee straight may sometimes be obtained by these means.

(2) *Operative Treatment.*—In cases of hydrops articuli, the synovial fluid may be let out and the operation of sclerogeny (p. 102) may be performed; or a drachm or two of camphorated naphthol may be introduced through the aspirating syringe, the joint being afterwards kept at rest. Radical measures must be adopted, and either arthrectomy or excision must be performed when suppuration has taken place, and simple incision and drainage have failed to cure; for it is important in these cases to secure bony anchylosis of the joint as rapidly as possible.

Arthrectomy or Erasion of joints is a term which has been adopted to denote the operation of removing all the diseased structures from a tuberculous joint. It is employed for those cases in which the stress of the disease has fallen upon the synovial membranes, and in the extra-articular forms of disease, the bones and epiphyses being only slightly affected. Its success depends, to a very large extent, upon minute attention to details. It should be the aim of the surgeon to remove every particle of diseased tissue—though, scientifically, this is not an absolute necessity, for we know that here, as in other tuberculous lesions, if the bulk of the disease be removed, the inflam-

matory processes thereby set up are able to destroy the slight manifestations of tubercle.

The operation was introduced into this country by Mr. Wright, of Manchester, in 1881, and its adoption has been ably advocated by Mr. Edmund Owen and by Mr. Clutton. The operation is specially adapted for the knee, and in a less degree for the ankle. It has the great advantage over excision, that in its most successful form it leaves a joint the movements of which are but little if at all impaired, whilst the limb is in no degree shortened. Its great disadvantages lie in the frequent relapses, necessitating repeated operations, and in the very prolonged convalescence. When the operation fails completely, the extensive suppuration militates against the more radical measures of excision or amputation which have then to be adopted.

The operation should be performed quite at an early stage of the disease, when it is obvious that rest will not be of any avail. The incisions are planned to expose the cavity of the joint to its fullest extent, yet to avoid its main ligaments and tendons as far as possible. The knee-joint may be opened either by an incision across the patella, or by division of the ligamentum patellæ, the knee-cap being turned upwards. If any fistulous tracts exist, the incision may be carried through them. The synovial membrane and peri-articular tissues are first examined, all the pulpy granulation tissue is carefully removed from before backwards with a pair of forceps and scissors, particular care being taken to clear out all the pockets, and to follow the diseased tissue where it has insinuated itself between the ligaments and tendons. The semilunar cartilages and the crucial ligaments are next picked clean, or even removed entirely if they are greatly diseased; otherwise, they should be left, though the synovial prolongations in their neighbourhood are carefully severed with blunt-

pointed scissors. The condyles of the femur are made to project, and the posterior part of the capsule is explored and cleaned as thoroughly as possible, a 1 in 10 solution of zinc chloride being applied to those parts which cannot otherwise be reached. The condition of the bones and articular cartilages next engages the attention of the operator. They are scraped and gouged until all ulcerated patches have been removed, and for this purpose a variety of gouges curved in different ways will be required. The articular surface of the patella is not to be overlooked. The bleeding points having been dealt with as they occur—since the bloodless method is not adopted in this operation—the whole of the joint cavity is again swabbed out with the solution of zinc chloride. It is afterwards well flushed with sterilised water; for if the caustic be not thoroughly washed away, the after-pain will be greatly exaggerated. Provision is made for the most efficient drainage, if it is considered necessary; though here, as in other cases, it is better to avoid the use of a drainage-tube if it be possible. The patella or the ligamentum patellæ, and the lateral ligaments, if they have been divided, are carefully sutured with horsehair, and the wound is closed. An antiseptic gauze dressing, with plenty of absorbent wool over it, is applied to the knee. The limb is bandaged from the feet upwards, and is then fixed upon a straight back splint. The drainage-tube is removed as soon as practicable. In many instances the suppuration is very prolonged, in others granulations sprout, cloacæ are formed, and a succession of secondary operations have to be done; but in some of the cases I have seen, the patient has ultimately had perfect use in the limb. All our efforts to prevent the spread of the disease sometimes prove futile, and excision, or even amputation, has to be performed in order to save the life of the patient.

Excision of a joint consists in removing the whole of the articular surfaces for injury or disease, and allowing either bony or fibrous anchylosis to take place between the ends of the bones. In children's practice, excision is only done for tuberculous disease. The operation is performed by most surgeons at a later period in the disease than arthrectomy, but by its most thoroughgoing advocates it is carried out at a comparatively early period. Mr. Howse,[7] for instance, says that when a well-marked case of pulpy disease has lasted over six months, it is not worth while, in the interests of the patient, to attempt the conservation of the joint for a longer period; but in saying this, he does not wish it to be understood that he would advise the excision of every joint which has been affected with tuberculous disease for six months. The advantages claimed for the operation are, that it affords a speedy and permanent cure of the disease, that a thoroughly serviceable limb is left, and that the risk of tuberculous infection is proportionately lessened.

Indications for Excision of the Knee.—Mr. Howse sums up the cases in which excision of the knee should be performed, under the following heads:—

1. In all cases in which the disease has advanced so far as to cause flaking of the articular cartilage, and grating in the movement of the joint, whether suppuration be evidently present or not.

2. Cases in which softening of the ligaments has extended so far as to give rise to backward displacement of the tibia.

3. All cases of over six months' duration, in which there is reason to believe that the disease has started in an epiphyseal osteitis, which has given rise secondarily to changes in the cartilage.

4. Cases of extensive suppuration in the knee-joint.

All cases of this description which have started from pulpy mischief should be excised. In suppuration which is pyæmic in its origin, incision should be first practised, and excision, only after evidence has been obtained of damage to the cartilages, or of such damage to the ligaments as to have caused displacement.

5. Cases in which the pulpy infiltration of the synovial membrane has advanced to any considerable degree over the articular cartilage.

6. Cases in which pulpy infiltration has extended beyond the capsular ligament to the crucial ligaments and semilunar cartilages.

Mr. Howse probably has had a larger experience in excision of the knee than any surgeon living, so that we may assume that these indications are the correct ones for excision of this joint. Amputation, on the other hand, must be performed in cases of joint mischief where there is lardaceous disease, where the lungs or viscera are affected, where the emaciation is very great, and where several joints are affected. Excision is not a very suitable operation when the joint disease is accompanied by extensive osteitis or periostitis, or where the tuberculous deposits are chiefly peri-articular.

The knee should be straightened as far as possible before the operation, by the judicious application of an extension apparatus and a moderate weight (fig. 15) for a week or ten days. The extension process is sometimes assisted by wrapping the whole limb in a mackintosh and then passing steam under it from a bronchitis kettle, so that the joint is put into an extemporised vapour bath. Chloroform must be given, and the adhesions must be gently broken down in all cases where an extension cannot be completed by the ordinary methods.

There are many methods of excising the knee-joint.

The one I generally use consists in making a semilunar skin-flap upwards, by cutting across the flexed joint from the back of one condyle to the back of the other, the knife being carried over the front of the leg, just above the tubercle of the tibia. The skin-flap is carried upwards until the quadriceps tendon is exposed. This is divided, and the patella is turned downwards. The joint is then laid open by dividing the extrinsic and, if necessary, the intrinsic ligaments; a very sparing use of the knife is sufficient, as the diseased tissues are very soft.

The saw is then applied to the femur, and the bone is divided transversely, so as to remove the condyles to the bottom of the intercondyloid notch, care being taken not to encroach upon the epiphysis. The bone is sawn from before backwards, and it is very important that it should be cut exactly at right angles to the long axis of the femur. This can be ensured in two ways: one by holding the bone over the end of the operating table and sawing vertically towards the floor, the other by laying it at full length upon the table and sawing until a good groove is formed in the bone, and in the proper direction, when the knee is flexed and the sawing is completed. The head of the tibia is then freed by carrying a knife round it immediately below its articular surface, and in such a manner as to divide all the soft structures. The saw is applied to the head of the tibia, and as little of the bone is removed from before backwards as possible. The patella is removed with this slice, for the ligamentum patellæ was divided by the circular incision. The tibial epiphysis must not be removed; but if the bone is found to be diseased beyond the point where it is sawn, it is often necessary to scoop away the cancellous tissue beyond the epiphyseal line. This may be done safely; for so long as the circumference of the bone is not nched upon, no harm results.

The operator next examines the soft parts, treating them exactly in the same manner as in an arthrectomy (p. 130), and it is attention to this detail which has restored excision to that place in surgery which a few years ago it seemed in danger of losing. The more the caseating material and the pulpy synovial membrane is removed, the greater is the likelihood of obtaining a firm and bony anchylosis without relapses, and a subsequent malposition of the limb. Yet, practically, it is impossible to remove every fragment of the pulpy synovial membrane; but this does not interfere with speedy and perfect repair, if only the bulk be taken away, for as I have already pointed out, there are strong reasons for believing that the normal inflammatory processes are able to deal effectively with small portions of tuberculous tissue, though they are unable to destroy it when it occurs in bulk. The diseased tissue is removed with dissecting forceps and a pair of blunt scissors curved upon the flat, and especial attention is paid to the various pockets and folds made by the synovial membrane.

The whole of the joint is then swabbed with a solution of chloride of zinc (40 grains to the ounce), and is flushed with boiled water at a temperature of 105° F. The bleeding is stopped by ligatures and firm pressure. The periosteum is then divided at corresponding points on the inner and outer sides of the femur and tibia, and a drill is passed obliquely through the bones. Sutures of stout silver wire or aseptic silk are passed through the holes. A drainage-tube is then laid along the back of the joint, so that it projects upon either side, and the sutures in the bone are drawn tight, so that the two raw surfaces are kept in accurate apposition. The skin is united by point sutures, the main ones of silver and the secondary ones of horsehair. There is a very great divergence of opinion as to the utility of pegging the bones together after excision of

the knee: many surgeons still considering that it is a useful if not an integral part of the operation, whilst many, and perhaps the majority, discard pegs altogether. The limb is then dressed antiseptically and is securely fixed in an extended position, either in a plaster-of-Paris splint, which should include the hip, or in some form of excision splint.

The splint employed by Mr. Howse (fig. 17) consists of two shallow troughs of sheet iron, tinned, and made so as to fit the shape of the leg and thigh. The foot-piece works in a slot, and the two troughs are connected at the back by

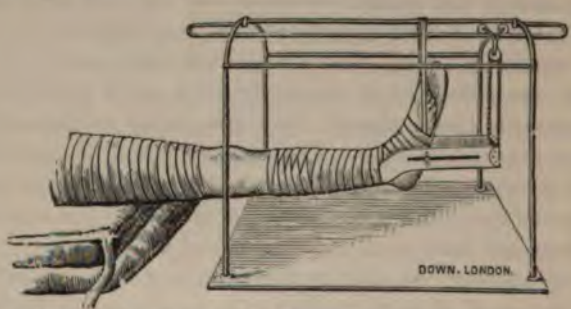

Fig. 17.—Howse's splint, with a swing cradle, for use after excision of the knee.

two strong bars of iron, made convex transversely so as to avoid cutting into the skin of the popliteal space. The bars are so arranged that the interval between the troughs, which corresponds to the excised joint, can be lengthened or shortened according to the case; and this interval, even in the youngest children, should never be less than four inches. The splint also has a small pulley at the bottom beyond the footpiece, by which the splint is slung to a cradle as soon as the limb is secured. Mr. Howse employs a peculiar system of fixation which he considers very effective. It will be found to be described in detail in the

Guy's Hospital Reports, vol. xlix., 1892. The first dressing is usually required at the end of forty-eight hours, and the subsequent ones at increasing intervals.

Abscesses or sinuses which are formed during the healing period must be scraped with a sharp spoon, and swabbed out with a solution of zinc chloride or other caustic in the ordinary manner. It is of the utmost importance that the limb should be maintained absolutely immovable for at least three months after the operation; and throughout this time the greatest care must be taken to maintain the leg exactly straight with the thigh, and to overcome the tendency which the thigh evinces to become rotated outwards, whilst the leg is kept by the splint and bandages in its normal position.

Bony union must be obtained, or the operation is worse than useless; and when the splint is removed and the patient is allowed to get about, he must still wear a leather splint moulded to his leg and thigh for a prolonged period, to prevent the gradual flexion which may mar the best immediate result.

Ankle.

Frequency and Pathology.—Tuberculous disease of ankle occurs in 15·75 per cent. of cases, so that it is less frequent in children than similar affections of the hip, knee, and elbow. It more often begins in the bones than in the synovial membrane, and it very generally commences in the cancellous tissue which is so abundant in the tarsal bones, the ankle only being secondarily affected. The disease is always progressive, and the chronic form of hydrops articuli, which is common in adults, is practically unknown in children.

Symptoms.—The symptoms are those which are common to tuberculous disease in the joints. Swelling, specially

marked upon either side of the tendo Achillis; limping, although the child can still walk considerable distances; limited joint movement, which is only noticeable at first in extreme flexion and extreme extension; heat over the joint; pain not usually well marked, and wasting of the leg.

Diagnosis.—A diagnosis has to be made as to whether the disease affects the ankle, the transverse tarsal joint, or whether it is confined to the tendon sheaths outside the joint; and this can only be done by a careful examination under chloroform.

Course.—Suppuration, with the formation of sinuses and slow ulceration of the articular cartilages, frequently takes place. The symptoms are so ill-defined that the parents often do not understand the serious nature of the disease, and the child is therefore not brought for advice until the disease has made very serious progress.

Treatment. (1) *Palliative.*—Few joint diseases yield more readily to rest, if it be taken in time. A well-applied plaster-of-Paris case for the ankle, with a Thomas' knee-splint (fig. 16) to keep the affected foot off the ground, will cure the patient, if at the same time he be put under good hygienic conditions. In some cases it is more advisable to apply a plaster case to the ankle, and to make the patient use a knee-rest, so that his foot does not come in contact with the ground.

(2) *Operative Treatment.*—When the sinuses have formed, or when there is clear evidence that the tarsal bones are infiltrated with caseating tubercle, the diseased spots should be exposed, scraped, swabbed with zinc chloride, flushed, and packed with camphorated naphthol on gauze.

Arthrectomy is required for the somewhat rarer cases in which the disease is essentially synovial in origin, and

Mr. Clutton has obtained most excellent results from this method, using multiple incisions and utilising for this purpose the sinuses.

Amputation is required in a few rare cases where the joint is disorganised, when there are extensive sinuses, and when the general condition of the child forbids the hope of recovery from any less severe measure. Syme's amputation is the best operation to perform, even if the disease involves the lower end of the tibia. After removing the foot and sawing off the malleoli, all the granulation tissue should be scraped away; the diseased centre of the tibia should also be removed, taking care to leave a ring of bone intact. The whole of the inflamed surfaces should be swabbed with a 1 in 15 solution of chloride of zinc, and after they have been well flushed, the flap should be attached with primary point sutures of silver wire and secondary sutures of horsehair. A drainage-tube may be laid in the posterior part of the wound, but it should be removed on the second or third day. Union by the first intention usually takes place even in the worst cases, the sinuses close at the same time, and only rarely present any recurrence of tuberculous disease.

Tuberculous Inflammation of Bursæ.

The large bursæ in the neighbourhood of joints in children sometimes become affected with tuberculous inflammation, leading either to a passive serous effusion or to suppuration. There is no doubt as to the tuberculous nature of the lesion, as the scar left after laying open the bursa sometimes becomes the seat of a tuberculous inflammation which may render its removal necessary.

Ætiology.—The exciting cause is usually a slight injury, and I have more often seen the bursa over the great trochanter affected than that in other parts, no doubt because

it is especially liable to injury in children, as they so often fall. There is every proof that during the early stages the inflammation is strictly limited to the bursa. The child does not limp or complain of pain, there is no rise of temperature, no muscular fixation of the neighbouring joint, and if an anæsthetic be given, the bone moves freely in its socket. The child's attendant usually discovers the swelling accidentally, and comes for advice about it.

Diagnosis.—These passive enlargements of bursæ are often of very serious import, and are of great diagnostic value, for they are frequently the first indications of tuberculous mischief occurring in a patient who otherwise appears sound. They must be distinguished from simple abscesses in bursæ, and from secondary infection of the bursæ due to tuberculous arthritis, which is the more frequent cause of such a condition. The slighter constitutional disturbance will distinguish the tuberculous from the traumatic abscesses, whilst the early appearance of the swelling, the joint being still healthy, will distinguish the primary from the secondary form of the disease.

Prognosis.—The prognosis must be guarded, for tuberculous trouble thus starting in a bursa will spread rapidly to the neighbouring joint, unless care be taken to prevent it.

Pathology.—The joint may be affected by extension along the lymphatics, or by the direct spread of tuberculous inflammation from the bursa, as by the bursting of the abscess into its cavity; but this does not happen if ordinary care be taken. The second method is more insidious, but at the same time the more frequent. The child is on the verge of tubercle, for the bacilli have established themselves in a single bursa, and have there caused a passive effusion. The tubercle bacilli have been able to effect this lodgment owing to the slight injury which the

bursa sustained, for this led to a diminished resistance on the part of its tissues. The congestion produced in the neighbourhood by the inflammation of the bursa is sufficient to enable the tubercle bacilli to effect a further lodgment, and thus an arthritis is started. The followers of Metchnikoff's teaching would explain the sequence of events in a somewhat different manner. Thus, the congestion leads to increased multiplication of tubercle bacilli. Increased multiplication of bacilli means increased invasion of the affected tissues by the various forms of leucocytes attracted in virtue of their chemotactic properties. The destruction of the phagocytic and other leucocytes which then takes place gives rise to the caseating masses known as tubercle. These masses are destructive to the functions of the joint in which they are formed, and if they become septic, are even inimical to life itself. The following cases illustrate the main features of this form of bursal enlargement:—

Case 1.—A delicate and very intelligent girl, aged 8 years, was brought to me because she had a swelling on the outer side of her left thigh. She appeared to be quite healthy in every other respect, and she had been running about as usual, until her mother accidentally noticed the swelling about a week previously. There was an obscure history of the child having fallen out of bed six or eight weeks before the appearance of the swelling. The swelling was in the situation of the bursa over the great trochanter on the right side; it was clearly a cold abscess, and the skin was absolutely healthy. The child was put to bed, her thigh was rendered aseptic, and the abscess was opened on the day after I first saw her. There was no doubt, when she had been anæsthetised, that her hip-joint was healthy. Six or eight ounces of pus escaped, and a large quantity of tuberculous material was scraped away

with a sharp spoon. I introduced my finger and assured myself that the abscess was confined to the bursa, and that it did not in any way communicate with the joint. The cavity was then thoroughly flushed with a warm solution of boric acid, was closed with horsehair sutures, without a drainage-tube, and was dressed with antiseptic gauze. The dressings were left untouched for a week; it was then found that the wound had healed, and that the swelling had disappeared, but that there was a little fulness beneath the scar. The sutures were removed, some clear serous fluid escaped through one of the suture holes, and the wound was again dressed with wet gauze. Three days later fluid had again collected beneath the line of incision to such an extent that the scar became stretched; gentle pressure opened one of the suture holes which had become closed by a small scab, and permitted of the escape of about an ounce of very clear and yellow serous discharge. This continued to drain away for ten days and gradually ceased. Three weeks after the operation the child was sent home cured.

Case 2.—A delicate girl, aged 4 years, who had suffered from superficial keratitis, was admitted under my care into the Victoria Hospital on June 4th. Her left buttock was noticed to be swollen eight days previously. She walked well, but could not sit with comfort. It was found on examination that the left buttock distinctly fluctuated, and that the swelling extended from the crest of the ilium to three or four inches below the great trochanter. An incision was made into it, and eight ounces of shreddy pus were let out. It was clear, when a finger was put into the cavity, that the abscess had been formed in the multilocular bursa situated between the glutæus maximus and the great trochanter. The abscess wall was thoroughly scraped away, the cavity was washed out with boric lotion, and

the wound was closed with horsehair sutures. It healed by first intention, the child went home cured, and she has remained well ever since.

Case 3.—A girl, aged 6 years, was admitted into the Victoria Hospital under the care of Mr. Pick. She began to halt on the left leg five weeks before admission. She had a large fluid swelling behind the left hip. The joint was freely movable, and did not appear to Mr. Pick to be in any way affected, as there was neither shortening, flexion, nor abduction of the limb. An incision behind the great trochanter allowed of the removal of much caseous material. The cavity which then remained extended beneath the glutæus maximus as far as the finger could reach. It had no connection either with the hip-joint or with the bone. The wound remained open for some time, but the child was kept at rest and with an extension apparatus. She was discharged six weeks later in a plaster-of-Paris case, and with a patten on the sound foot.

Case 4.—A girl, aged 1 year, was admitted to the hospital under my care, with a fluid swelling about the size of a hen's egg situated over the great trochanter. The movements of the hip were absolutely unimpaired, but the child was ill and had digestive troubles. An incision was made into the swelling, and three ounces of yellowish red pus were let out. It was again clear, when the finger was introduced into the cavity, that the abscess had been formed in the bursa. Three weeks later the wound had almost healed, but the thigh was flexed at the hip and there was much lordosis. An extending weight of a pound was attached to the leg. Three days later the child's general and local condition had greatly improved. She had regained her appetite, the leg was straight, and she had no lordosis. Six weeks later her usual posture in bed was on her back kicking both legs freely in the air.

She was therefore sent home as cured. It is obvious that this child just escaped an attack of tubercular arthritis.

Case 5.—A boy, aged 4½ years, was admitted into the hospital, under the care of Mr. Waterhouse, on account of an enlarged patellar bursa. The knee appeared to be unaffected. The bursa was dissected out, and was found to be the seat of tubercular disease. Primary union of the wound took place at every part except where a small drainage-tube had been inserted, and there a sinus formed. The knee became affected with pulpy degeneration, and six weeks later it was found to need excision. On opening the joint for this purpose the synovial membrane was seen to be invaded everywhere by tubercular granulation tissue. There was no disease either of the cartilages or of the bones. A continuous tract of tubercular tissue, however, could be traced from the old scar at the side of the prepatellar bursa to a spot in the synovial membrane of the knee, just above the patella, where the tubercular material had undergone caseation. This case differs, therefore, from the preceding ones in the fact that the joint became affected by direct extension from a tubercular focus.

Case 6.—I was asked to see a boy of 17, employed as a gardener in a small village, who had developed a painless fluid swelling in the situation of the bursa over the great trochanter. He evinced an unconquerable aversion to leaving home, or to any form of treatment by rest. He continued his occupation from the time I saw him in March until the end of July. His hip then became affected with acute arthritis, and in two months he was dead of general tuberculosis.

It is evident from these cases that passive enlargement of the bursæ in children is of considerable importance both in diagnosis and in prognosis: in diagnosis, because effective treatment should be adopted at once; in prog-

nosis, because it is clear that unless great care be taken the worst results are to be apprehended.

Treatment.—The treatment to be adopted is that given in the successful cases, and it follows directly from the pathology. If the passive effusion into the bursa be seen before suppuration has occurred, the fluid should be let out by means of an incision rather than by aspiration. Why, we know not, but we do know that in such passive effusions due to tubercle, and notably in tubercular peritonitis with simple effusion, a cure more often follows after a free incision than after a puncture, even though the wound heal by first intention. If suppuration has occurred, the abscess must be opened, scraped, thoroughly cleansed, and every effort must be made to get it to heal at once. Union by first intention is of vital importance in these cases, for if it can be secured the patient will in all probability escape further trouble.

Suitable precautions are to be taken at the same time to secure physiological rest for the joint, whilst the general hygiene of the patient must be improved; for it should never be forgotten that when the bursæ are enlarged in this manner, the patient has already passed the threshold of tubercular disease. If the wound fail to heal by first intention, there is danger lest the slight increase of inflammation so produced may hasten the tubercular process, and thus the operation will have done more harm than good. It is perhaps better for this reason not to insert a drainage-tube, but to close the wound in its whole extent.

CHAPTER VII

TUMOURS AND SYPHILITIC DISEASE OF BONE

TUMOURS OF BONE.

INNOCENT tumours of bone occur more frequently in children than sarcomata. They are chondromata, exostoses, and much more rarely lipomata and cysts.

CHONDROMATA.

Chondromata spring either from the interior of short bones, like the phalanges, or they grow subperiosteally in the neighbourhood of the epiphyses of long bones. They may also grow from the bones of the skull; but whatever may be their origin, they are innocent, though in some cases they may attain so large a size as to render the limb useless and necessitate amputation. They are recognised by their hardness and by their immobility. They grow slowly and are usually painless.

Treatment.—No operation is needed in the case of enchondromata of the fingers, unless they are unsightly, cumbersome, or rapidly growing. They can often be extirpated, but occasionally more radical measures are necessary. They frequently undergo calcification, and they may suffer mucoid and fatty degeneration; in some cases cysts are formed in them.

Exostoses.

Exostoses originate either from chondromata which have become ossified, or they are formed directly by the periosteum; the latter are the rarer. They are usually situated near that epiphysis which grows most quickly. They may be single, or they may occur in very large numbers in different parts of the skeleton. The single exostoses growing near an epiphysis either originate outside the joint from the epiphyseal line, or much more rarely from just within its capsule, in which case they are enclosed in the synovial membrane, when they appear to originate from the articular cartilage itself. It is of great importance to remember the latter variety, as any attempt to remove such a tumour will involve opening the joint. There is usually no difficulty in recognising exostoses, although their typical appearance is sometimes masked by an adventitious bursa which is occasionally formed over them, and by the fact that in some cases they consist of two parts, one superimposed upon the other, and separated by a kind of false joint. Ivory exostoses are less frequently seen in children than in adults, but when they are met with they occur in similar situations.

Exostoses are usually painless, even in parts subject to constant irritation, for they are protected by a cap of cartilage.

Treatment.—Palliative means are generally sufficient for their treatment, though it may occasionally be necessary to remove them, as when they spring from the terminal phalanx of a toe. When they spring from the epiphyseal line, they may become attached to the diaphysis instead of to the epiphysis, and so may be carried upwards until they are found at some distance from the extremity. They are then likely to be mistaken for sarcomata.

Parosteal Lipomata.

Parosteal lipomata sometimes grow from or are intimately connected with the periosteum of long bones, to which they are attached by a very broad base. I showed an instance of such a growth at the Pathological Society of London, in 1888. It was taken from a boy, aged 9 years, who was admitted into St. Bartholomew's Hospital, under the care of Mr. Smith. He had a soft, painless, and elastic swelling extending over the upper third of the left thigh, and along its outer aspect. The skin was normal and freely movable over the tumour, but the superficial veins were slightly distended. The tumour weighed 15 ozs. after removal, and was divided into several lobes. In spite of this case being well impressed on my mind, I mistook the last example that I saw for a chronic abscess of the thigh. These tumours are always congenital, and may be mistaken for an abscess or for a sarcoma, the only certain means of diagnosis being an exploratory puncture with an aseptic grooved needle. They had better be removed when their size hampers the movement of the limb.

Fibrous Epulis.

Fibrous epulis is a hard and dense tumour, covered with healthy, congested, or ulcerated mucous membrane. It usually springs from the gums between two teeth or from the periodontal membrane, and it projects more upon the lingual than upon the buccal side of the alveolus. The tumour grows slowly, and I have only seen it in connection with the permanent dentition.

The **Treatment** consists in extracting a tooth, and it sometimes happens that the epulis comes away with it; if it does not, it must be removed, and if necessary, a part of the jaw must be taken away as well. The growths do not recur.

Cystic Tumours of Bone.

Cystic tumours of bone are either simple, parasitic, or malignant (p. 150).

Dentigerous Cysts occur either in the upper or lower jaw, and usually in connection with the permanent dentition. They form single tumours, which expand the bone as they grow, and are filled with a clear serous fluid. They may be due to errors of development in the tooth sac, to faulty position of the teeth, to normal persistence of a deciduous tooth which should be shed to make room for its successor, or to the presence in the jaw of supernumerary teeth.

Treatment.—The cyst should be laid open without making any skin incision, as soon as its nature is recognised, and the tooth removed. The bones soon recover their natural shape and size.

Parasitic Cysts are due either to hydatids or to actinomycosis, but both are so rare in England that they do not require more than to be mentioned here.

SARCOMATA.

The malignant tumours of bone are either endosteal, of which the myeloid form is limited to children and to young adults, or it is periosteal, taking the form of round or spindle-celled growths, of which the ossifying sarcoma presents somewhat peculiar features. The jaws and the long bones are particularly obnoxious to the growth of sarcomata, but an infiltrating form of sarcoma is not very uncommon in the bones forming the vault of the skull. Some of these cases run an acute course, and become very widely disseminated. Nothing can be done for them, and they fortunately soon involve the brain, leading to uncon-

sciousness. The sarcomatous growth, in one case which I saw, was of a sage-green colour (p. 446).

Myeloid Sarcomata.

Myeloid sarcomata are nearly always central in origin. They spring from the long bones near their articular ends, and they occur more often in young adults than in children. They grow slowly, and cause such expansion of the bone that it may become a mere shell, which eventually gives way and allows the growth to infiltrate the surrounding tissues and to spread and disseminate like a periosteal sarcoma. Such endosteal sarcomata are usually cystic; they may pulsate, they rarely affect the articular cartilages, and they lead, in some cases, to spontaneous fracture. The tumours they produce are usually of an ovoid or spheroidal shape, except when they grow subperiosteally, and they are then irregular and lobed.

Prognosis.—The prognosis is not so bad as for other sarcomata in children, recurrence is somewhat less likely to occur, and when it does occur the secondary growths are not necessarily of the myeloid type, for they may consist of any other form of sarcomatous tissue. The lymphatic glands are more often implicated in children than in adults.

Treatment.—The treatment consists in excising the affected portion of the bone, or in the enucleation of the growth when it is limited and the case has been seen early. Amputation, however, should be performed if there is any reason to suppose that the surrounding parts are affected; for when this has been done, there is the least likelihood of a recurrence.

Blood Tumours.—Mr. Roughton has recently dealt with the blood tumours of bone. They are of great rarity, and he considers that they are sometimes angeiomata and

sometimes angeio-sarcomata. He quotes a case in which such a tumour was clinically innocent, though microscopic examination showed that it contained myeloid cells. The case was that of a girl, aged 4 years, who hurt her leg by a fall ten months before she came under Mr. Roughton's care. A tumour slowly developed in the interior of the tibia, and gradually expanded the bone until eggshell crackling could easily be detected. There was neither pain, tenderness, redness, nor œdema; the knee-joint was natural, and there was no enlargement of the lymphatic glands either generally or locally. The thigh was slightly wasted, probably from disuse. The contents of the tumour proved to be a dark red fluid, looking like altered blood and serum. The cavity was stuffed with lint, and eventually healed well.

Malignant Epulis.

The sarcomatous epulis grows from the periosteum of the alveolar border of the jaw—the upper more often than the lower—and from the first is of a much more livid colour than the fibrous epulis. The lividity is partly due to pigment granules, which are present both in the cells and in the stroma of its tissue. A malignant epulis usually contains numerous giant cells. It does not, however, run a very malignant course, and there is no recurrence if it is removed by resecting a piece of the jaw. Neither form of epulis should be mistaken for the mass of "proud flesh," which is sometimes seen in children's gums as a result of carious teeth, or after extraction; for these growths are much softer, bleed more freely, and are clearly not covered with mucous membrane.

Periosteal Sarcomata.

The periosteal sarcomata spring from the deeper layers of

the periosteum of any of the long bones. They are either round or spindle-celled, mixed or fibrous.

Ætiology.—They may occur at any time in childhood, and are seen even in infants. They can be traced a little more frequently to direct injuries in children than in adults; otherwise, they run a similar course and must be treated upon the same lines. The tumours grow more rapidly and disseminate more freely than in older persons.

Ossifying Sarcoma.—Sarcoma affects the long bones and the cranial bones in children.

Diagnosis.—It is very likely to be mistaken for a tuberculous arthritis of the knee when it grows from the lower end of the femur; or it may be looked upon as an osteitis, a chronic abscess of bone, or as a mass of peri-articular gummata. It may be distinguished, however, from all these conditions by its steady increase in size, and by the early enlargement of the lymphatic glands when the cylindrical bones are affected.

Symptoms.—The tumour grows rapidly, so that the disease runs an acute course. The annexed case, which I narrated some years ago at the Pathological Society, illustrates the ordinary course of the affection.

A girl, aged 13, noticed a slight pain and stiffness in her left knee immediately after a long country walk. The stiffness continued, in spite of treatment for three months; but it was not severe, and the patient was able to do her ordinary school work. Her knee was observed to be swollen three months after the stiffness was first complained of, and it was treated for tuberculous synovitis. The swelling increased rapidly, and an enlarged and densely hard gland appeared in the groin. Her thigh was amputated in the middle third, and a month later the enlarged gland was removed from the groin. It was then found to be so firmly attached posteriorly to the sheath of

the femoral vessels that an inch of the femoral vein had to be removed with it. A mass of new growth was detected in the pelvis, shortly after the removal of the gland, and a month before the death of the patient there were symptoms of a secondary deposit in the lungs.

Treatment.—This case and others like it show that the only effective treatment is amputation of the limb as soon as the diagnosis is established, and, if possible, before the glands are affected and before dissemination has taken place.

SYPHILITIC DISEASE OF BONE.

Syphilis attacks the bones of children in several ways.

Long Bones.

(1) *Osteomyelitis* is one of the very earliest symptoms of inherited syphilis. The long bones of children under a week old are sometimes found to be affected with a plastic osteomyelitis, chiefly affecting the periosteum, producing bony deposits, and leading to thickening of the epiphyseal lines. The epiphyseal lines themselves are affected primarily in children under three months old.

Symptoms.—The symptoms are ill-defined, for the child does not appear to be in pain until his limbs are handled, he is lethargic, and he does not move about like a healthy baby. Examination of his limbs shows that there is a marked thickening at the line of the epiphysis in several of the long bones, and a diagnosis of rickets is therefore often made. In course of time, if he be left untreated, the enlargement increases, and one or more of the epiphyses separate, so that the limbs become quite helpless. Suppuration occasionally takes place, the abscess usually bursting externally, though the joint is sometimes involved. If the child dies before suppuration has occurred, the

thickening of the epiphyseal lines is found to be due to the formation of a semi-transparent gelatinous material, containing small yellow nodules of gummatous substance, and it has a great tendency to suppurate or to caseate. The degeneration is sometimes red instead of yellow. This condition has been carefully studied by Parrot, who has given it the name of chondro-osteitis.

Diagnosis.—It has to be distinguished from rickets, scurvy, chronic septic osteomyelitis, and osteosarcoma, as well as from the earlier stages of tuberculous disease of the epiphyses.

Prognosis.—Its prognosis, even in the worst cases, is most satisfactory. I have seen one or two cases, however, in which such inflammation of the epiphysis led to permanent shortening of the bone.

Osteomyelitis also occurs in older children. The radius and ulna and the tibia are most often affected, but the vertebræ and the phalanges do not always escape. This form of syphilitic spine and syphilitic dactylitis is likely to be mistaken for its more common tuberculous congener. Syphilis, however, affects the periosteum more than tubercle, and in the spine the syphilitic deposit takes place at more than one spot, with intervening healthy tissue, whilst in tubercle the lesion is rarely multiple.

(2) *Osteitis.*—A chronic sclerosing osteitis sometimes affects the long bones, and leads to their thickening and bending. Necrosis takes place in other cases, associated with great rarefaction of the surrounding bones. Lastly, there is a true gummatous ulceration of the long bones, associated with a similar condition of the joints. This occurs in young adults, and is more fully described at page 231.

(3) *Decalcification.*—A remarkable decalcification of the bones sometimes takes place in syphilitic children between

the ages of five and six months. The decalcification is occasionally general, and it is then likely to be mistaken for rickets, and to be treated ineffectually. It may be confined to one or two bones, and it then seems to be the result of a local gummatous deposit, which may lead to that variety of spontaneous fracture which is occasionally seen in the ribs.

Skull.

The bones of the skull are affected by syphilis in a manner similar to the long bones, though less frequently. Hutchinson and Parrot first drew attention to the fact that, at variable periods within the first two years of life, osteophytic growths appear on the outer surface of the cranial bones, and in definite positions, viz. on the frontals and parietals, at the boundaries of the anterior fontanelles, extending backwards parallel with the sagittal suture. These elevations are lens-shaped, and of a violet or red colour, porous in character, and grooved by vascular channels. They extend gradually, and bridging over the sutures may lead to synostosis of the skull, and so to a condition of microcephalus. Similar conditions are also met with in rickets, so that in difficult cases too much stress must not be laid upon Parrot's modes in making a diagnosis of syphilis.

Doughy swellings, which may ulcerate or suppurate, sometimes appear on the heads of syphilitic children. They present the ordinary characters of soft nodes, and may do serious injury to the bones, for they may cause craniotabes, or that condition of the skull in which the bones yield and feel like parchment when pressure is made upon them. The process of ulceration commences on the outer side of the bone, is well defined, and of limited extent. It may be distinguished from the craniotabes of

marasmus and rickets by the fact that it is not limited to the part of the skull which is most liable to pressure, for it may involve the parietals and the anterior part of the occipital bones.

M. Parrot also describes an atrophic lesion of the skull, due to a gelatiniform transformation of the bony material, similar to that seen in the epiphyseal lines.

A sclerosing process is sometimes seen in the skulls of young adults who have been the subjects of inherited syphilis, for the calvaria is very thick and dense, and the sutures are wholly absent. The syphilitic disease of the skeleton is characterised by its slow course and by its painlessness.

Diagnosis.—It has to be distinguished from acute osteomyelitis, from tuberculous disease, and from sarcoma. The disease is sudden in onset in osteomyelitis; it is attended with more fever, and the swellings suppurate more readily. It is often difficult to distinguish the bony lesions of syphilis from those produced by tubercle. The condition of the child, its snuffles, its muddy complexion, the rash about its anus, the peeling of the palms of its hands and the soles of its feet, and the mucous patches about its mouth and anus, will serve to complete the differential diagnosis in young children; whilst in older ones the stunted growth, the peg-topped and crescentically notched permanent incisors, the deafness, and the interstitial keratitis will serve the same purpose. Sarcoma is only likely to be mistaken for syphilitic disease of bone in its earliest stages, for it runs a rapid course in children, and very soon involves the soft parts.

Prognosis.—The prognosis of syphilitic disease in children is most satisfactory, even in the worst cases.

Treatment.—One-grain doses of grey powder three times a day for a child of six or eight weeks old, with the

inunction of a 5 per cent. solution of oleate of mercury, or of blue ointment, soon work a marvellous change. The child in a very short time loses its marasmic condition, its pseudo-paralysis disappears, for the separated epiphyses reunite, sinuses and fistulæ close, and the patient is rapidly restored to health.

CHAPTER VIII

INJURIES OF BONES

FRACTURES AND SEPARATED EPIPHYSES.

Ætiology.—Fractures in children present several interesting deviations from similar injuries in adults. Apart from those produced by direct or indirect violence, there are intra-uterine, congenital, ricketty, and spontaneous varieties. The ordinary traumatic fractures are most frequent in children under twelve, in the radius, humerus, clavicle, femur, and leg. The jaws, nose, fingers, and skull are less often broken, whilst the sternum, scapula, and pelvis are only damaged after the most extensive injuries. In addition to the injuries of bones usually met with in adults, children present two special forms—the "greenstick" fracture, and separation of the epiphyses.

Symptoms.—The symptoms of fracture are the same as in adults, but are not usually so well marked. It should be remembered in making a diagnosis that the pain of a fracture in a child is often inconsiderable, whilst the crepitus may be much less distinct than it is in an older person, partly because the periosteum remains unruptured in a certain proportion of cases, and partly because the separation may not involve ossified tissues, if it has taken place near an epiphysis. The deformity, too, is often much less, because the fracture is not so oblique, and the muscles are weaker. Inattention to these points, and the difficulty of recognising "greenstick" fractures,

may lead inexperienced surgeons to overlook a fracture which is only too obvious as soon as callus has been produced. Such errors in diagnosis react in two ways—upon the surgeon by lessening the parents' confidence in him, and upon the child by increasing the risk of an ununited fracture from want of restraining apparatus.

Course.—Fractures in children heal with great rapidity, and, as a rule, with great certainty, owing to the activity of the formative processes which take place in their bones, and there is often an exuberant formation of callus. The subsequent modelling process is carried out so perfectly, that after a few months it is often impossible to ascertain the exact seat of the injury, even when a section of the bone is made.

Sequelæ.—The sequelæ of fractures are few. I have seen non-union in various bones, the persistence of deformity and shortening, chiefly after injury near the epiphyses, and crossed union in the bones of the forearm, owing to carelessness in the application of splints. Gangrene may be produced by the application of too tight a bandage, but it is fortunately of very rare occurrence.

Treatment.—The general treatment consists in immediate and perfect reduction, and this is especially necessary in separated epiphyses, so that an anæsthetic is often required, and the subsequent application of appropriate restraining apparatus. Nothing is better for this purpose than a well-fitting plaster-of-Paris splint or case. Non-union I believe to be nearly always due to imperfect fixation of the broken ends of the bone. Its prognosis is very unsatisfactory in children, for in spite of wiring, grafting pieces of bone or periosteum, local irritation, and other means, a useless limb too often results, and amputation may have to be performed. A few successful cases of wiring are on record, and in ununited fracture of the

clavicle, at any rate, a useful arm may exist in spite of non-union of the fragments.

Spontaneous Fractures.

"Spontaneous fractures" are those resulting from violence which would be insufficient to break a long bone under ordinary conditions. They are secondary to other diseases of bones, to muscular action, or, much less commonly, to trophic changes connected with diseases of the central nervous system. Sometimes, as in scurvy, they are due to constitutional causes, and some children and families seem to have peculiarly brittle bones without any other evidence of ill-health (see p. 161). It is also associated with phosphaturia, and it is met with in diabetes; sarcomata or other endosteal tumours lead to it. Spontaneous fracture of the tibia is sometimes the result of an osteitis caused by injury.

I have seen a spontaneous fracture of the tibia in a child who had central necrosis of the femur, in which, after amputation of the thigh, the tibia and fibula, though physiologically healthy, were reduced to a mere shell, and even the compact tissue was riddled with holes until it looked like lace-work, the changes being due to interference with the blood supply, resulting from the chronic inflammatory changes in the thigh. Spontaneous fracture is said to occur in some cases of infantile paralysis of long standing, as a result of advanced degenerative changes taking place in the bone, and it is even less frequently met with in cases of hydrocephalus. Such cases of spontaneous fracture must not be confused with the spontaneous separation of the epiphyses which takes place shortly after birth, as a result of syphilis, or with the spontaneous fractures sometimes connected with changes in the bone during the early stages of rickets. In syphilis and rickets the prognosis

of spontaneous fracture is good, for under the influence of appropriate treatment repair takes place, whereas in the other cases it is bad, and amputation will be required.

Osteopsathyrosis.

Spontaneous fractures occurring in scurvy must be distinguished from spontaneous multiple fractures occurring in individuals who have an hereditary tendency to fracture.[12]

Ætiology.—We know very little of this remarkable condition, except that the bones repeatedly become broken as the result of very slight violence.

Symptoms.—The symptoms are those of an ordinary fracture, except that there is less pain, with less swelling and bruising of the soft tissues.

Diagnosis.—Osteopsathyrosis or fragilitas ossium must be distinguished from the other causes producing spontaneous fracture which have been enumerated above.

The number of fractures, the good health of the child, and the history of heredity, transmitted solely in the male or in the female line, are sufficient to make certain the diagnosis of true osteopsathyrosis.

Prognosis.—The prognosis is good, for the fractures repair well under the ordinary methods of treatment. In a case in the St. Bartholomew's Hospital Museum, however, which was under the care of Mr. Langton, who has kindly given me leave to publish the details, the patient died with sarcoma at the age of thirty. At eleven years old he fractured the upper part of his right humerus whilst he was throwing a cricket ball; the bone united. In 1874 he slipped and fell, fracturing his left humerus; the bone united. In November, 1878, he fell whilst playing football, and again fractured his right humerus just above the condyles; the bone united. In June, 1880, he broke

his right femur by a twist, owing to his left leg slipping under him: the bone broke as he stood; it united partially, but not firmly, and there was much eversion. In spite of the non-union, and although there were three inches of shortening, the patient said that he could walk sixteen miles in a day, at the rate of three and a half miles an hour. His right heel slipped whilst coming downstairs in February, 1884, and to save himself from falling he swung round, grasping the banisters with both hands; the left femur broke above the condyles as he was standing, but he did not fall. The union was satisfactory. The bone, however, began to bend at the seat of fracture two years later, and movement began three and a half years after the injury. In September, 1888, he noticed movement at the seats of fracture of the right humerus, owing, as he said, to excessive use. In April, 1889, a sarcoma formed in the right arm, which grew until November, 1889, when it was deemed advisable to remove the arm at the shoulder. Recurrence took place in the scar in February, 1890, and the patient died in June, 1890, from secondary deposits in the internal organs.

Intra-uterine Fractures.

There appears to be no doubt that injuries to the abdomen of a pregnant woman may cause one or more fractures in the fœtus. Fractures so caused usually unite, sometimes in good position, sometimes with a greater or less amount of deformity; occasionally they remain ununited. Such intra-uterine fractures are of course to be distinguished from true congenital fractures produced at the time of birth.

Traumatic Separation of the Epiphyses.

These accidents[13] are necessarily confined to young persons, though different epiphyses are liable to separation at

different times. Some epiphyses, like that of the femur, are more often separated early in life; whilst others, like the olecranon, are only separated comparatively late. The separation may be accurately through the epiphyseal line, as is usual in infants, or it may involve a portion of the shaft of the bone, as is not unusual when the injury occurs between the ages of twelve and sixteen.

Separation of the epiphyses occurs most frequently at the lower end of the femur, next at the upper and lower ends of the humerus, at the lower end of the radius, and at the lower end of the tibia. The particular dangers of epiphyseal separation lie in the fact that the joint either is or may be affected, for the capsule in many joints includes the epiphyses, as may be seen by referring to the coloured plate (p. 96). Some epiphyses are more liable to become displaced after they have been separated than others, for some are pulled aside by the muscles attached to them, whilst others have no such muscular attachments. Permanent deformity or serious secondary injuries may therefore be produced by such injuries, even when the greatest pains have been taken during the process of repair. The periosteum is often torn away from the shaft of the bone for a considerable distance by the separation of an epiphysis, so that periostitis in its various forms may result. Suppuration is by no means uncommon, even after a simple separation of an epiphysis, due, no doubt, to the tendency which septic micro-organisms show to settle in the neighbourhood of an injured epiphysis. Necrosis results from this suppuration. Finally, if all goes well immediately after the accident, and the epiphysis unites firmly and in good position, premature ossification may take place, leaving a stunted and often atrophied limb.

The diseases and injuries to which epiphyses are liable have been most exhaustively studied by Mr. Jonathan

Hutchinson, jun., and by Mr. Tubby, whilst Mr. Sturrock has collected many interesting examples.

Fractures of the Skull.

Ætiology.—Cranial fractures in young children are always the result of direct violence, and they present certain remarkable peculiarities which mark them off very clearly from similar injuries in adults. In the first place, fractures of the skull are uncommon in children, for the bones are so thin, homogeneous, and elastic that they readily yield to external violence, and bend rather than break. Extensive fissured fractures, therefore, do not occur with anything like the same frequency that they do in adults, and depressed fractures with splintering of the inner table are practically unknown, though Mr. Staveley reminds me that the Museum of St. Thomas' Hospital contains a typical example produced by the pecking of a hen. Their place is taken, however, by those cases in which a depressed piece of bone is driven beneath the neighbouring intact bony vault. Permanent depressions of large tracts of the parietal or frontal bones are not rare, and, on the other hand, I have seen a variety of green-stick fracture in the parietal bones marked by a convexity beneath the pericranium, following injuries received during birth.

Secondly, as Mr. Rickman Godlee has shown, the bones are united by soft sutures, and as the fontanelles are not closed, the whole force of the injury falls upon the part struck. The dura mater is very firmly attached to the interior of a child's skull. It follows, therefore, from these two conditions that a fracture of the vault is nearly always attended by laceration of the dura mater, whilst severe injuries to the brain substance are much more frequent after such accidents in children than they are in adults. The

brain injuries are often overlooked, partly because they give rise to few and uncertain symptoms,—for a child's brain shows great power of adapting itself to altered conditions, —partly because such symptoms as do occur after a slight compound and fissured fracture do not manifest themselves until many days or weeks after the injury, and partly because the thinness of the bone and the yielding nature of the skull allow of extensive damage to the skull without laceration of the scalp. Cases of simple fissured fracture in children sometimes gape widely, perhaps because the freely movable bones allow of a considerable displacement of the fractured parts. Marchant has shown that in fractures of the skull occurring in children under ten years of age, rupture of the middle meningeal artery much more frequently gives rise to external hæmorrhage than to the ordinary intracranial hæmorrhage.

Hernia cerebri sometimes results from a compound fracture of the skull. It is a dangerous condition, as death often results from meningitis, or from inflammation of the cerebral substance. The tendency to it may be lessened by keeping the wound aseptic; but if, unfortunately, a hernia should occur, the granulation tissue must be scraped away, the soft parts may then be refreshed, loosened, and brought together over the wound. The pericranium may be slightly detached, and shavings of fresh bone, obtained from some other part of the body, may be introduced into the aperture in the skull before the wound is closed.

Traumatic Cephalhydrocele or Meningocele.

A remarkable form of injury occurs in very young children, to which Dr. Conner has applied the name traumatic cephalhydrocele, though it is better known as traumatic meningocele.[14]

Symptoms.—The condition is characterised by a fluid swelling developing slowly at the seat of injury some weeks after a fall upon the head, usually in children under three years of age. The swelling in some cases pulsates, and it may have a respiratory rhythm. It is always in direct communication with the subarachnoid space, for if it is punctured cerebro-spinal fluid escapes, and probably in every case the opening in the skull is also connected with the ventricles of the brain.

Pathology.—The exact pathology of these swellings is still a matter of doubt. They undoubtedly start from a simple fracture of the skull, associated with rupture of the dura mater. Mr. Clement Lucas believes that there has also been laceration of the brain substance, reaching to the cavity of the lateral ventricles. The substance of the brain softens, and there is an increased secretion of cerebro-spinal fluid owing to the irritation thus set up. The pressure from within and the yielding of the brain together contribute to the escape of the fluid from the ventricles. A hernia of the cerebral meninges takes place, and this, by the constant pressure which it exercises, leads to absorption of bone; and as the tumour lies outside the skull, the absorption of the bone takes place from without inwards.

Diagnosis.—The diagnosis is easily made if the history can be obtained correctly, or when clear cerebro-spinal fluid is drawn off through an aseptic puncture. The swelling may be mistaken for a hæmatoma, but it may be distinguished by its tendency to remain stationary, or to increase in size, whilst a hæmatoma diminishes. The prognosis is grave.

Treatment.—The treatment varies in individual cases. Puncture may cure the tumour when the opening in the skull is small; but when there is a free communication between the two sides of the cranial bone, it is unlikely

that much good will follow such an operation. It is noteworthy that most of the reported cures have taken place where no operative treatment has been adopted, whilst in many cases death from meningitis has followed tapping. The surgeon must therefore be absolutely sure of his asepsis before he punctures such a swelling.

The tumours in many cases are stationary, and palliative treatment by the use of a gutta-percha shield is perhaps best, for in a certain proportion of cases the tumour has disappeared spontaneously.

Fractures of the Skull in Young Adults.

Fractures of the skull in older children whose skull has consolidated present no peculiarities. They follow the same course, and must be treated upon the same principles as those which govern similar injuries in adults.

Nasal Bones.

Ætiology.—I have seen several cases of broken nose in children resulting from falls upon the face, or in older boys from diving into shallow water in swimming baths, as well as from other forms of direct violence.

The nature of the injury is often masked by the effusion of blood. It is of extreme importance, however, to recognise the fracture at once, for repair takes place by first intention, often leaving a marked deformity. A very careful examination under chloroform should therefore be made in all cases of suspected fracture, that is to say, when after an injury there is flattening and lateral deviation of the nose. Attention must be paid at the same time to the condition of the nasal cartilages and the septum nasi, as they are often displaced, either wholly or in part.

Treatment.—There is usually but little tendency to displacement, so that it is sufficient to replace the frag-

ments in the proper position. If it is difficult to maintain their position, however, or if the deformity recurs, Mason's treatment must be adopted. The fragments are elevated and replaced by means of a pair of dressing forceps, and a hare-lip pin is passed through them as far back as possible. Its ends are cut off so that they project for a short distance upon either side, and a piece of adhesive strapping or an india-rubber band is passed from one end to the other. The fragments are thus supported posteriorly as well as laterally. The needle should be withdrawn at the end of a week.

Lower Jaw.

Fractures of the lower jaw are very rare in children; but Hamilton records instances and gives details of cases, as well as of one which would have been called a greenstick fracture if it had occurred in a long bone.

Treatment.—A gutta-percha splint should be made for the chin, and it should be kept in place by a four-tailed bandage until the swelling has subsided. A mould of the alveolar border of the lower jaw should then be taken in wax. A Hammond's splint is then made by accurately adapting a piece of stout silver or platinum wire round the bases of the teeth in a cast made from the mould. The ends of the wire being soldered, the splint is transferred to the patient's mouth, and is kept in place by a thin silver wire run in and out between the teeth.

Clavicle.

A broken collar-bone is one of the commonest accidents which a surgeon is called upon to treat in infants and young adults, and it is the one most frequently overlooked. There is no danger of mistaking it when it is complete, and there is a clear history of an accident; but when it is of the greenstick variety, when the periosteum

is intact, and when a careless nurse who has dropped her baby gives a purposely misleading history, the diagnosis is often most difficult. The pain is then often attributed to teething or other trivial causes, and close and prolonged observation will alone show that the injured arm is not used as readily as the opposite one.

Treatment.—The treatment for an infant in arms consists in binding the arm to the side with a roller bandage, and dressing the child so that the injured arm is kept inside its clothes for a fortnight; for an older child this is supplemented by keeping its arm in a sling for another week. This method should be adopted in every case in which a fracture is suspected, and in very young children it is a safe precaution to adopt whenever there has been an injury to the shoulder. The arm should be kept at rest for ten days in doubtful cases, as by that time the formation of callus will establish the diagnosis, whilst if there has only been a bruise the surgeon will have erred upon the right side. The only cases of ununited fracture of the clavicle I have seen were those in which the injury had been overlooked and the children had been allowed to go about without any restraining apparatus.

Sayre's method of applying two pieces of stout strapping is as effectual for young adults as any other. One piece of strapping three inches wide is stitched loosely round the injured arm opposite the insertion of the deltoid. An assistant is directed to draw the arm downwards and backwards to stretch the clavicular fibres of the pectoralis major, and whilst this is being done the surgeon carries the strip backwards round the body so that the sticky side adheres to the skin. He then stitches the end to the encircling band in the middle of the back. The assistant is next told to bring the elbow forwards and inwards so that the hand lies flat upon the

opposite shoulder. The humerus is thus supposed to act as a lever, throwing the shoulder outwards and preventing the two fragments of the clavicle overlapping; but I greatly doubt whether its action is more than temporary. A second piece of strapping is carried obliquely across the sound shoulder, in such a way that the point of the elbow on the injured side is received into a slit made in the strapping, whilst the hand and forearm are also covered. A flannelette bandage may be applied over the whole to keep everything in place. The apparatus is left on until firm union has taken place, which is usually at the end of a fortnight or three weeks.

The Epiphysis of the Clavicle.

The sternal extremity is sometimes torn off in young persons.

The **Symptoms** are undue prominence of the inner end of the bone, and the presence of a sharp bony extremity beneath the skin. Mr. Christopher Heath says that in a case which came under his notice in a boy, aged 14, the supra-sternal notch was quite distinct and equally defined on both sides; the presence of a thin lamella of bone on the injured side could be clearly detected as it lay between the notch and the gap formed by the forward projection of the shaft of the clavicle.

Diagnosis.—Separation of the epiphysis has to be distinguished from fracture on the inner side of the rhomboid ligament, but the fracture is farther away from the joint.

The **Treatment** consists in keeping the patient flat upon his back in bed for fourteen days.

Humerus.

Every variety of fracture occurs in the humerus in children; but separation of the epiphyses and injuries to its lower extremity are of more especial interest.

Separation of the Upper Epiphyses.

Separation of the epiphyses in the upper end of the humerus either includes the head of the bone, or it chiefly involves the greater tuberosity.

Separation of the whole of the upper epiphysis takes place after the sixth year, for it is only then that the nuclei for the head unite with that of the greater tuberosity to form a single mass. It is generally met with about puberty, and the separation results from direct violence to the shoulder. It is likely to be mistaken for a sub-coracoid or sub-clavicular dislocation. Careful examination will show that the head of the humerus lies in the glenoid cavity, whilst in some cases the upper end of the lower fragment can be felt beneath the skin; in this case the projecting mass of bone may readily be mistaken for the head of the humerus.

Symptoms.—The arm is helpless, and the upper end of the shaft projects abruptly beneath the coracoid process, so that the axis of the arm is altered and the elbow is directed a little outwards and backwards. There is abnormal mobility just below the shoulder-joint,—which is best demonstrated by abducting the humerus,—with rapid swelling about the shoulder and some shortening if the diaphysis is wholly displaced. There is muffled crepitus when the diaphysis is brought into contact with the separated epiphysis. The deformity can be reduced by extension and counter-extension, but it is immediately reproduced when the arm is left to itself.

Prognosis.—The prognosis is not very good, for as Mr. Hutchinson, jun., points out in his excellent essay on the diseases and injuries of the epiphyses,[13] there is sometimes great difficulty in maintaining the fragments in good position when the upper epiphysis of the humerus has

been separated. This difficulty he attributes to the fact that there may be a longitudinal rent in the periosteum through which the upper end of the shaft projects, and this rent may have to be enlarged before the shaft can be replaced. Good union does not take place readily; but in spite of this a useful arm results, though there may be some shortening from interference with the growth of the bone.

Treatment.—Steady traction should be made upon the arm, and slight abduction, aided by a rotatory movement; and if the reduction is once fairly effected, the epiphyseal line is so sinuous that the parts remain in fairly good apposition. Splints should be applied, and the shoulder treated as if for a fracture, by flexing the forearm, and bringing it forwards so that the fingers lie upon the opposite shoulder; this carries the elbow well across the chest, and the injured arm is then fixed securely with a broad flannel bandage. Some means of extension may be employed advantageously in older children.

Separation of the Greater Tuberosity.

The great tuberosity is usually torn off by direct violence, but sometimes it has been separated by muscular effort. The tubercle is drawn upwards and backwards towards the back of the acromion process, whilst the shaft of the bone is drawn upwards and inwards by the subscapularis, pectorales, latissimus dorsi, and anterior fibres of the deltoid.

Symptoms.—These changes in position lead to a great widening of the shoulder and a marked prominence of the coracoid process on the injured side. The separated epiphysis can often be taken between the finger and thumb, and can be moved into its natural position; and

if the arm be extended at the same time, the deformity can be temporarily overcome.

Treatment.—The best results are obtained by putting the patient to bed, raising the arm above the head, and securing it in such a position that the greater tuberosity lies over its point of separation. The surgeon must in many cases content himself with applying a gutta-percha or leather cap moulded to the shoulder, and fitted with a pad on its inner surface, with the object of retaining the great tuberosity in position, when from any reason the child cannot be kept in bed.

Shaft.

Fractures of the shaft of the humerus do not differ materially in their causes, symptoms, or treatment, from similar injuries in adults. There is not so great a risk of non-union since there is less displacement of the fragments, as the periosteum is often less torn than in adults. Good repair usually takes place in a fortnight under any method of fixation, but the injured arm should not be used for a month. An internal angular splint with an external straight splint or a piece of a "kettle-holder" (Gooch's) with a sling usually affords sufficient fixation, and I prefer it to a plaster-of-Paris splint, at any rate for the first fortnight.

Elbow.

Fractures in the region of the elbow[14] are very numerous and very complicated in children. They are usually the result of falls in young children, and of direct violence in older ones.

Treatment.—Anchylosis is so common after these fractures in the immediate neighbourhood of the elbow that there is the greatest diversity of opinion in respect to

their treatment. One school of surgeons advocates the arm being maintained in a state of flexion, whilst another holds with equal tenacity that extension yields the better results. I prefer the flexed position myself, and I always employ it in these cases. The method adopted by Prof. Busch, of Bonn, is a serviceable one. It consists in maintaining the limb at an angle of about 120° until the swelling has subsided; the elbow is then bent to an acute angle for a week or ten days. It is carefully straightened under an anæsthetic upon the twentieth day until it has been extended to an angle of 180°, and the splint is again applied until the twenty-eighth day, when it is permanently laid aside.

A formal operation may have to be performed when anchylosis has taken place, if the adhesions cannot be broken down. The joint is exposed by an incision carried along its outer side, the callus is removed or the articular ends are divided with a chisel until the fragments can be replaced in their proper relationship to each other. The arm must then be fixed upon a rectangular splint, and the case treated as if an excision had been performed.

Separation of the Lower Epiphysis of the Humerus.

The lower epiphysis may be separated at any time up to the 13th or 14th year, though the separation is somewhat more frequent in children under four years of age. It ossifies from four nuclei; that for the internal condyle forming a separate epiphysis from that of the articular surface and external condyle, and uniting with the shaft later.

Ætiology.—The lower epiphysis may be torn off by forcible adduction or abduction, and it sometimes follows a fall upon the hand with the elbow bent.

Mr. Jonathan Hutchinson, jun., says that in these cases there is more or less complete backward displacement of the epiphysis, with an abnormal projection backwards of the olecranon, more marked when the arm is extended than when it is bent. There is therefore an increase in the antero-posterior diameter of the affected elbow, rendered more marked by the rapid swelling within the joint, which is a usual concomitant of the injury. Voluntary movement is limited, but there is abnormal mobility just above the elbow, corresponding to a line drawn transversely at or just below the epicondyles.

Diagnosis.—Separation of the lower epiphysis must not be mistaken for a backward dislocation of the radius and ulna, though it bears a superficial resemblance to it, as the lower fragment is tilted backwards beneath the triceps, whilst the upper fragment projects forwards. When the radius and ulna have been dislocated backwards, the lower end of the humerus can be felt to bear its articular surfaces; whilst after separation of the epiphysis the articular surfaces are carried backwards with the forearm, and only the naked end of the shaft of the humerus projects in front. This lower end sometimes presses upon the brachial artery, until it has caused gangrene, or there may be injury to the nerves.

Treatment.—The patient should be put to bed, and his arm laid upon a Stromeyer's cushion with the elbow flexed. An evaporating lotion, consisting of equal parts of methylated spirit and lotio plumbi, should be applied until the swelling begins to subside. A plaster-of-Paris case may then be moulded to the arm, and it should be kept in position by means of a bandage and a sling for three weeks. The child may leave his bed after the tenth day.

Supracondylar Fractures of the Humerus.

Ætiology.—These injuries are rare in children, but when they occur they are produced by a fall from a height or by a blow or kick. They are often compound.

Symptoms.—The line of fracture is nearly always oblique, so that the lower fragment projects backwards beneath the triceps, as in separation of the lower epiphysis. Gentle extension applied to the forearm reduces the deformity, but it is reproduced as soon as the arm is left to itself. There is so much swelling attending both these injuries, and they are often so obscure, that no certain diagnosis can be made until the child is anæsthetised.

Treatment.—Supracondylar fractures should be treated like a separation of the epiphysis, by placing the arm midway between pronation and supination, so that the thumb is uppermost. The elbow is bent and the arm is secured to a well-padded rectangular plaster-of-Paris splint applied along its inner side. Passive movement should be commenced upon the twentieth day, and the muscles of the arm should then be shampooed daily.

T-Fracture.

Ætiology.—The supracondylar fracture in children is sometimes complicated by a vertical fracture extending downwards through the lower fragment into the joint, thus forming the well-known T-fracture.

Symptoms.—There is usually no difficulty in recognising this form of fracture. The elbow is swollen and shapeless, the joint is full of blood; and if the child be anæsthetised, the fragments of bone can readily be moved upon each other.

Prognosis.—The prognosis in these cases is of necessity grave, for the joint is seriously implicated; but the repara-

tive power in children is so great that I have seen most useful arms follow even the worst injuries of this nature.

Treatment.—The treatment consists in placing the child under chloroform, and remodelling the elbow until the fragments are in good position. This is done by forcibly extending the arm, and then pressing the upper end of the ulna downwards and forwards, whilst the forearm is being pronated and flexed to an acute angle with the upper arm. The arm may then be placed upon a Stromeyer's cushion, over which a mackintosh sheet has been laid. The cushion is supported upon a board projecting from the cot, or upon a low, flat table placed alongside it, so that the arm is extended from the body with the elbow bent to a right angle. An extension apparatus may be applied if there is any marked tendency to shortening. An evaporating lotion of Goulard extract and spirit or an ice-bag is applied to the elbow, and every means is taken to allay excessive inflammation. A well-padded angular splint should be applied to the flexed arm as soon as the swelling has somewhat subsided, and gentle passive movement combined with massage should be commenced on the twentieth day after the injury. The split condyles of the femur are generally displaced laterally. Dr. Dulles[14] has lately shown that if the forearm be fully flexed so that the hand touches the opposite shoulder, and if at the same time it be semi-pronated, the radius and ulna hold the corresponding points of the lower end of the humerus in tolerably good position. He therefore advocates that fractures of the elbow-joint should be treated in this position, and this may be done by means of flexible metal or felt splints carefully moulded on to the arm.

Fractures of the Epicondyles.

Fractures of the epicondyles are not uncommon, for they

often occur as a complication of dislocations at the elbow; fractures on the inner side of the joint being rather more frequent than those on the outer.

Cause.—The accident is sometimes the result of direct violence, and sometimes it is due to indirect injury. Mr. Jonathan Hutchinson, jun., points out that separation of the inner epicondyle is nearly always a clean separation of the epiphysis on the inner side, and that it often unites by fibrous tissue alone, but without materially impairing the usefulness of the arm. The separated epitrochlea is drawn downwards towards the ulna, and by its pressure upon the nerve it may give rise to paralysis of the muscles supplied by the ulnar, with pain and limited movement of sufficient severity to warrant the removal of the fragment of bone.

Treatment.—The limb may be kept for three weeks in a plaster-of-Paris splint moulded on to the fully flexed elbow.

Intra-articular Fracture of the Capitellum.

Fracture through the external condyle of the humerus is also of frequent occurrence in children, as a result of falls upon the elbow.

Symptoms.—The detached fragment is usually displaced a little outwards, and carries the head of the radius with it, so that the distance between the two condyles is greater on the affected than on the sound side. Crepitus is most easily obtained by seizing the fractured condyle between the finger and thumb, and lightly moving it upon the humerus.

Prognosis.—The prognosis must be guarded in these cases, for the simple fracture is often complicated by other injuries which may be overlooked at the time of the injury owing to the swelling which it causes. A good

instance of this occurred in a case which I saw with Mr. Pick about a year ago. A school-boy, aged 10, fell backwards out of a window, a distance of fifteen feet, into a paved area, and sustained a severe injury to his elbow. The injury involved the joint, and when I saw him three months afterwards there was impaired movement, thickening at the back of the external condyle, and inability to extend or fully to flex the forearm. A diagnosis was made that the external condyle had been fractured, and that there was now a forward dislocation of the radius. Mr. Pick reduced the dislocation under chloroform. The arm was fixed at a right angle in a plaster-of-Paris splint, and six weeks later the boy had good movement in the joint, which has since become perfect, for he tells me that he can now ride and drive without difficulty. The capitellum is very liable to remain as a loose body in the elbow-joint, and it may then lead to considerable impairment of movement and serious disorganisation of the elbow, though it does not undergo necrosis.

Treatment.—The arm should be placed upon a rectangular splint for a fortnight, when passive movement must be commenced, the splint being replaced after each *séance* until the end of the third week, when it may be laid aside. Mr. Hutchinson suggests that when the external condyle fails to unite, it may be necessary to fix the detached fragment by a needle, or to peg it by some other means to the surface from which it has become detached, the needle being removed at the end of three or four weeks.

Forearm. Separation of the Epiphysis of the Olecranon.

The nucleus for the ossification of the olecranon appears

at the tenth year, and the epiphysis unites with the shaft about the seventeenth year.

Ætiology.—This injury is generally the result of direct violence.

Symptoms.—The symptoms are semiflexion with loss of power to extend the arm, great effusion into the elbow-joint, and a more or less marked gap at the back of the elbow.

Prognosis.—The prognosis is not good; fibrous union may result, or anchylosis may take place.

Treatment.—The treatment is the same as for a fractured olecranon. The arm should be laid at rest upon a cushion for a week until the swelling has subsided, the patient being kept in bed. A pad is then placed above the separated epiphysis, and is secured with a strip of plaster in such a manner as to keep the two fragments in apposition, and a plaster-of-Paris splint is applied to the flexor aspect of the arm from the axilla to the wrist, to keep the arm fully extended. The plaster splint is left on for a fortnight, and upon the twenty-first day from the accident it is removed, and the arm is gently flexed to an angle of 100° to 120°. A fresh splint is applied, and at the end of a month or five weeks systematic passive movement of the joint with massage of the limb is commenced.

Separation of the Upper Radial Epiphysis.

Separation of the upper epiphysis of the radius is rare, but Mr. Mansell Moullin showed an example at the Pathological Society in 1888. It occurred in a boy of sixteen, whose arm was crushed by a machine.

The more common injury, which is often diagnosed as a separation of the upper epiphysis, partakes more of the nature of a strain, and is perhaps due to a partial dis-

placement of the head of the radius, caused either by the head slipping downwards, or to the orbicular ligament slipping upwards. Its exact pathology, however, is unknown, but it is considered more in detail at page 242.

The accident occurs in infants and in young children who have been held up or swung round by their hands. The forearm is painful; it is held motionless, and is incapable of being completely extended or supinated.

Free movement of the arm is obtained by first bending the elbow, and then gently but completely supinating the arm. The arm should be bandaged to an angular splint for forty-eight hours, and an evaporating lotion should be applied to the elbow. Mr. Jonathan Hutchinson has pointed out that such accidents are very likely to be followed by disease of the elbow-joint in tuberculous children, just as the more severe forms of sprained elbow may form the starting-point of an acute infective arthritis.

Shaft.

Fractures of the shafts of the radius and ulna are not more numerous in children than they are in adults, nor do they differ much in their signs or in their treatment. The surgeon, however, has to be on his guard against overlooking those cases in which one or both bones are broken subperiosteally, or in which they are only bent or partially fractured, for such injuries are accompanied by the production of as much callus as though a complete fracture had taken place. Dr. Brossard has shown that subperiosteal fractures of the ulna are produced by indirect violence applied when the arm is adducted, for in this position the force is transmitted directly along the bone. It may also be produced by twisting the arm into a condition of extreme supination, for the posterior surfaces of the two bones are then brought into such intimate contact that

the ulna is bent backwards. A similar twist into exaggerated pronation may cause a spiral fracture of the radius. The fracture is a mere fissure, and it may be accompanied by an incomplete transverse fracture, or even by a tearing away of the lower epiphysis.

Symptoms.—The symptoms most to be relied upon in these cases of incomplete fracture are pain and swelling limited to the seat of injury. They are extremely likely to be mistaken for simple bruising, as there is neither deformity nor undue movement of the bones.

Treatment.—Any deformity in the bones must be accurately remedied. The surgeon must be careful to see that the radius and the ulna lie parallel to each other throughout any prolonged application of splints, and that the splints are sufficiently wide to prevent the bandage from pressing upon the sides of the arm and so squeezing the bones together, for crossed union takes place very readily, and little or nothing can be done for the relief of a patient who has two or three inches of callus in his interosseous space. The bandage over the splint may be starched, but a plaster-of-Paris splint had better not be applied.

Three weeks is a sufficient length of time to keep the arm fixed.

Separation of the Lower Epiphysis of the Radius.

Ætiology.—The lower epiphysis of the radius is occasionally separated by falls upon the outstretched hand, and I think that, with the increase of bicycling, it is becoming rather more frequent in young adults. An injury which in adults would lead to a Colles' fracture, leads in young children to this accident, to a dislocation of the radius and ulna backwards at the elbow, or to a broken collar-bone.

Symptoms.—The symptoms of separation of the lower epiphysis resemble those of the fracture immediately above the articular surface of the radius, to which English surgeons give the name of Colles. Pronation and supination of the arm are impossible; the radial border of the forearm is shortened, and the styloid process of the ulna is unduly prominent. The line of separation sometimes involves part of the shaft of the bone, so that the crepitus may be more obvious than is usually the case in separation of an epiphysis.

Diagnosis.—The deformity produced by separation of the lower radial epiphysis is almost identical with that occurring in Colles' fracture. It may be distinguished, however, by observing that the outline of the wrist is angular, whilst in fractures it is curved. The projection, too, upon the palmar surface is more obvious after epiphyseal separation than after a fracture.

Prognosis.—The lower radial epiphysis unites quickly, and the repair is usually so perfect, that after a few months it is difficult to identify the line of separation. The growth of the radius, however, may be arrested as a result of the injury sustained by the growing line.

Treatment.—The deformity must first be reduced. A Carr's splint is then applied, the fingers being confined for the first week. The splint should be replaced by a plaster-of-Paris mitten at the end of three weeks, and this should be worn for a fortnight.

Ribs.

Ætiology.—Fractures of the ribs occur in children who have been run over, or have sustained other serious injuries, but they are not very frequently observed. The thorax is so elastic that such fractures are only produced

by considerable violence, and more than one rib is usually injured.

The prognosis is therefore unsatisfactory, for the injury is often severe enough to have implicated the lungs, or even the heart; and I have more than once seen a hæmothorax produced within a few hours after a child has been run over.

Symptoms.—The symptoms vary greatly with the nature and extent of the injury, and are more dependent upon the complications than upon the broken ribs.

The **Treatment** consists in keeping the child in bed, and treating the complications as they arise.

There is a specimen in the Museum of St. Bartholomew's Hospital, in which the heads of the third, fourth, and fifth ribs are separated from their necks. The patient was a girl of two, who was run over by a dray. She died instantly, and the lung was found to have two large rents in its posterior border. I hesitate to call this injury a separation of the costal epiphyses, as the angular epiphysis for the head of a rib does not appear until the sixteenth year.

Diagnosis.—Traumatic fractures of the ribs must not be mistaken for broken ribs resulting from rickets, or more rarely from localized gummatous deposits in cases of inherited syphilis. Such cases readily heal under appropriate constitutional treatment, aided by strapping applied to one side of the chest in the ordinary manner.

Femur.

Fractures of the femur are of very common occurrence in children, and they may occur at any part of the bone.

Upper End.—Very obscure injuries occur at the upper end of the femur, and they often lead to permanent lameness. These injuries were for many years supposed to be

associated with separation of the upper epiphysis. Several surgeons—Dr. Royal Whitman amongst the foremost—have recently brought forward good arguments to prove that in a certain proportion of these cases the neck of the femur itself is fractured, though there can be no doubt that the upper epiphysis is often separated. In some cases, too, the fracture is only partial, and causes a greenstick fracture, which leads to bending of the neck of the bone.

The separation of the epiphysis is the result of a sudden wrench or sprain, whilst the fracture of the neck is produced earlier in life, and by a less severe injury, as a fall or blow.

Symptoms.—The symptoms in either case are shortening of the limb, with elevation of the great trochanter above Nélaton's line to the extent of three-quarters of an inch. There may be either external rotation of the thigh, or it may be inverted. There is usually pain on movement and some swelling about the joint, with inability to use the limb.

Diagnosis.—These injuries may be mistaken for a dislocation of the hip, if a history of injury is forthcoming; but if the child is only seen some time afterwards, the symptoms are often attributed to hip disease, or to the effects of infantile paralysis. The freely movable joint, the character of the deformity, and the absence of trophic disturbance, should enable the surgeon to suspect the nature of the injury even in the absence of any history as to its cause, but it is generally impossible to ascertain its exact nature.

Prognosis.—The prognosis is not very good in young children, for the injury is frequently overlooked until the patient learns to walk. An ununited fracture may be the result of this neglect, or the fragments may unite in a faulty position. Permanent lameness is caused, but the

limb is otherwise serviceable. Mr. Tubby has lately shown that separation of the upper epiphysis of the femur is most common after the age of fourteen years; that the prognosis of union is not better when it occurs at this age, but that, as in younger patients, a serviceable limb is usually obtained.

Treatment.—The application of a plaster-of-Paris splint to the thigh and pelvis gives satisfactory results, if the child is seen soon after the injury. The splint should be put on whilst the child is anæsthetised, and extension should be maintained until the plaster has set. The splint should include the pelvis. A Thomas' splint, with extension, is also a good method of fixing the limb in these cases; but slight abduction of the thigh must be maintained, so that a useful limb may result in case anchylosis of the hip takes place.

Separation of the Great Trochanter.

The great trochanter is sometimes separated in patients under the age of seventeen years, and this form of injury must be distinguished from extra-capsular fracture of the neck of the femur, and from dorsal dislocation of the hip.

Diagnosis.—The diagnosis is difficult, for there is no shortening of the limb after separation of this epiphysis, and the trochanter on the injured side describes the same arc when the thigh is rotated as it does on the sound side. There is usually local pain, with slight swelling.

Treatment.—The treatment consists in the application of a Thomas' hip-splint. There seems to be a special liability to suppuration, and even to pyæmia, after this injury, so that too favourable a prognosis should not be given. The patient must be kept in bed until the surgeon has satisfied himself that sufficiently firm union has taken

place, to prevent movement setting up any inflammatory processes at the seat of injury.

Shaft of Femur.

Fractures of the shaft of the femur are common in young children, and are produced by comparatively slight violence. They are more frequent in the ricketty than in the healthy.

Symptoms.—The thigh assumes such a characteristic position that the nature of the injury can hardly be mistaken; but the absence of pain and the difficulty of obtaining crepitus sometimes cause the fracture to be overlooked. It is often nearly transverse, and there is generally very little overlapping of the fragments. It may be incomplete, and of the greenstick variety.

Prognosis.—The prognosis is very good, for bony union without shortening is usually the result of every rational method of treatment.

Treatment.—There are many ways of treating a broken thigh in childhood. The simplest is to put the patient upon a fracture bed, and to apply a Gooch's splint, *i.e.* a "kettle-holder," to the whole thigh, securing it in place by webbing straps. An extension of two or three pounds, or of so great a weight as is necessary to steady the limb, is applied to the leg, and this is usually reckoned as a pound for each year of the child's age. The method of applying extension is identical with that described at page 116, and seen in fig. 15. There is firm union in three weeks, but I prefer to keep the child in a plaster-of-Paris case for a fortnight after the splint has been removed. A plaster splint (p. 212), with extension, may often be applied with advantage from the beginning. A long Liston's splint, applied along the uninjured side, should be used in both methods to compel the child to lie straight.

Children who have incontinence of urine, very young children, and those who have both thighs broken, can often be treated satisfactorily without any splint, by keeping them flat upon their backs and rigging up an extension apparatus consisting of a weight and pulley so situated above the bed that the thighs are flexed to a right angle with the body. The method is not well adapted for private practice, however, and in little girls it sometimes leads to an attack of vaginitis.

Restless children, who cannot be induced to lie straight and flat by any other means, are best secured in a Bryant's or in a double Thomas' splint.

Dr. Elefson states that he has most successfully treated a fracture in the upper part of the thigh of a new-born child by the application of well-padded antero-posterior splints of plaster, the thigh being fixed in complete flexion upon the abdomen for fifteen days.

Separation of the Lower Epiphysis of the Femur.

This is not a very rare injury in young people. It is more frequent in boys than in girls, and it is most frequent about the age of sixteen years.

Ætiology.—It occurs in its simplest form and without displacement as a result of traction during labour, and from wrenching the thigh during the operation of manual osteoklasia. A much more severe form results from accidents. The violence in these cases is always very great, and in thirteen out of twenty-six cases collected by Mr. Tubby it was produced by such a wrench as might be caused by getting the leg entangled in a revolving wheel.

Pathology.—The epiphysis in the more severe cases is always considerably displaced. It may pass forwards,—which is most usual,—backwards, or sideways, the exact

direction appearing to vary with the nature of the injury producing it. When the epiphysis is displaced backwards into the ham, or when the end of the shaft passes backwards and the epiphysis lies in front of it, there is a very real danger of pressure upon the main vessels and injury to the large nerves in the popliteal space. In such cases the large veins may become the seat of infective thrombosis, gangrene results, and may lead to the death of the patient.

Symptoms.—The pain varies in intensity according to the injury done to the nerves; the knee is generally semi-flexed, and often much swollen. The foot is everted, and there may be an inch or two of shortening. The epiphysis can be felt in its new position, and there is undue lateral movement of the leg, including the knee-joint, with obscure crepitus in cases where there is but little displacement.

Diagnosis.—The separation of the epiphysis must be distinguished from dislocation of the knee, and from supra-condyloid fracture of the femur. The downward and backward direction of the epiphyseal line usually allows the lower end of the shaft to project backwards into the popliteal space, whilst the lower fragment is displaced forwards, and can readily be felt.

Prognosis.—The prognosis in the simple cases is good, for perfect repair usually takes place. It is far otherwise in the varieties which have been the result of severe violence, for the injury may then be compound, or the backward pressure may lead to gangrene from thrombosis, or to secondary hæmorrhage from pressure and ulceration.

Treatment.—The treatment in the simple cases consists in putting up the limb in a plaster-of-Paris splint, with the knee fully extended. The patient must be anæsthetised when there is displacement, and the epiphysis

must be accurately replaced. This is done by making extension and counter-extension upon the leg and thigh, whilst the surgeon manipulates the epiphysis. The leg is then carefully put up in two lateral plaster-of-Paris splints, taking care that the epiphysis does not become displaced. The splint should be kept on for a month, the surgeon being on his guard during the earlier period for the slightest symptoms of complications. The femoral vein may be ligatured when there is reason to suppose that it is the seat of an infective thrombosis; but in some cases, and especially if gangrene result, amputation is sometimes unavoidable. Excision may be required in uncomplicated cases when it is impossible to replace the epiphysis.

Patella.

Fractures of the patella do not occur in young children, and in young adults they present no peculiarities by which to distinguish them from similar injuries in the full grown.

Cause.—They are usually the result of direct violence or of muscular action.

Bones of the Leg.

Separation of the tubercle of the tibia may take the place of a fractured patella in a child, and is readily mistaken for a broken knee-cap.

Treatment.—The treatment for this injury consists in the application of a straight back-splint to the leg, which is then raised to an easy angle with the body, in order to relax the quadriceps muscle. The separated tubercle may be kept in place by a piece of strapping, and the leg must be kept at rest for six to eight weeks.

Shafts of Tibia and Fibula.

Fractures of the tibia and fibula are tolerably frequent in children, but they are much less common than fractures of the thigh. They are often compound in children who have been run over; but even the worst cases of compound fracture of the leg are usually amenable to conservative surgery, and it is only in the most exceptional cases that a primary amputation is necessary. The upper epiphyses of the tibia and fibula are occasionally separated by violence, but fracture is most common in the middle and lower third of the bones.

Treatment by plaster-of-Paris splints usually ensures good repair in three weeks; but it should be borne in mind that non-union is more common in the tibia than in any other bone in a child, and the patient should therefore be kept in bed, and not allowed to sit with its legs dangling from a high chair.

Lower Epiphysis of the Tibia.

The lower epiphysis of the tibia is occasionally separated, either by direct traction during childbirth or by a sprain. The periosteum is not necessarily torn, and the accident may therefore escape notice. The ordinary treatment for a Pott's fracture should be adopted. In older children, separation of the lower epiphysis of the tibia is often compound, and is associated with a fracture of the fibula.

Metacarpal Bones.

Fractures of the metacarpus are very rare in children, except as a result of machine accidents in our manufacturing towns. Mr. Jonathan Hutchinson, jun., has recently shown that many cases of supposed dislocation and fracture

he metacarpal bones are in reality separated epiphyses n the injury is situated at the phalangeal extremity. treatment consists in the application of a well-padded r's splint to the forearm, and securing the fingers for a night over the end of its transverse portion.

Metatarsal Bones.

ractures of the metatarsal bones usually occur from foot being run over. The pain and swelling are sufnt to confine the patient to his bed. The foot should fixed in a plaster-of-Paris bandage as soon as the lling has subsided.

CHAPTER IX

CONDITIONS LEADING TO ALTERATIONS THAT REQUIRE SURGICAL INTERFERENCE IN BONES AND MUSCLES

ANTERIOR POLIOMYELITIS.

INFANTILE paralysis in its acute stages usually comes under the notice of the physician, but a thorough knowledge of its course and pathology is required by the surgeon, on account of the frequency with which he is called upon to treat its more remote effects.

Ætiology and Pathology. — The cause of infantile paralysis is usually an acute and often well-localised inflammation in the multipolar nerve-cells of the anterior horn of the grey matter of the spinal cord, though there is some evidence to show that in a few cases of infantile paralysis the lesion is primarily in the brain, and more often on the right than upon the left side. The predisposing and exciting causes of the inflammation are quite unknown to us. It is most frequently seen in young children after the beginning of the teething period, but it may occur in young adults. The inflammatory process terminates in the disappearance, shrivelling, or pigmentation of the affected cells, and in alterations of the axis cylinders originating in them, leading to degenerative changes in the voluntary muscles supplied by them. The functions of the nerve-cells appear to be largely trophic, for after their

disappearance the muscular fibres shrink in size, and the contractile substance often disappears entirely, so that the fibrous elements alone remain. The bones, the tendons, and the ligaments also undergo similar atrophic changes, in part the result of trophic disturbances, but chiefly secondary to the muscular paralysis, for they are partly due to disuse, partly to the mechanical causes produced by the changes at the joints.

Symptoms.—The onset is acute, and may be so sudden that, as in the case of Sir Walter Scott, a child who goes to sleep in apparent health has been known to awake paralysed. The temperature rises to 100° or 102° F., and there is sometimes a twitching of the affected limbs. Pain is not a prominent symptom, and the sphincters are not relaxed. The paralysis is at first more widely spread than it afterwards proves itself to be. The muscles which are permanently affected waste in the course of two or three weeks, and cease to respond to the faradic current, though galvanism produces exaggerated contraction as compared with the sound side. This alteration in the excitability of the muscles is known as the reaction of degeneration. It is of great service in prognosis, since as a broad and general rule the muscles which give this reaction for a period of six to nine months after the onset of the disease, will remain permanently paralysed.

Treatment.—The general treatment to be adopted in these cases, when the acute symptoms have passed away, is to keep the muscles in the best condition to resume their functions if their nerve supply is regained, and at the same time to regulate the vascular supply to the parts, and so to prevent, as far as possible, the chilblains and ulceration which form so troublesome a feature in limbs which have been paralysed for long periods of time. These indications for treatment are met by recommending the

parents to bathe the child daily in a hot bath at a temperature of 80° F. for ten to fifteen minutes, and afterwards to rub some lin. camph. co. into the affected part. The surgeon should himself shampoo the child two or three days a week. Ten-minute applications of the galvanic current for very long periods of time afford the most satisfactory method of local treatment. The child must be carefully educated to this treatment by commencing with weak currents, and care must be taken not to fatigue the muscles. Large electrodes render the application less painful than small ones, and the positive pole should be applied over the affected part, as it is less painful than the negative one, which can be placed over the spine. A current of three milliampères should be used first, and may be gradually strengthened after a few sittings to six. A dozen contractions of the muscles is sufficient at first.

Care must also be taken throughout the treatment to obviate deformities, or to prevent their increase, by the use of splints or light steel supports, for if this be satisfactorily effected it will save many troublesome operations. The various forms of talipes, stunted limbs, dislocations, contracted and flail joints are the most frequent results of infantile paralysis. Club-foot must be treated upon the ordinary principles by division of the tendons or by the subsequent application of supports. Carefully adjusted orthopædic apparatus will prevent contraction of the joints, and may assist a patient who has a flail joint.

Arthrodesis.[16]

Arthrodesis is the operation performed to anchylose a joint in order to secure an orthopædic result. It was first done by Albert, at Vienna, on July 20th, 1878, and it has since been repeatedly performed in London by Mr. Howse and Mr. Jacobson, and in Liverpool by Mr. Robert Jones.

It is of especial service in cases of infantile paralysis of long-standing, at the knee when the limb is flail-like, and at the ankle when there is so much varus that division of the tendons and the application of orthopædic apparatus have failed to rectify the deformity. It has also been recommended for the treatment of similar paralytic conditions in the arm, and in cases where the paralysis has followed typhoid fever and variola, or has been due to neuritis; and von Winiwarter has excised the wrist in a case of infantile paralysis affecting the arm. Those who have performed the operation most frequently speak of it in terms of high praise; but no case has yet come under my care in which I have felt justified in departing from the ordinary rule of amputating through the thigh for the relief of this condition when the use of suitable apparatus has failed. The chilblains, the ulcerated condition of the skin, and the extreme degeneration of the muscles have always led me to think that the artificial production of an anchylosed joint would be of less service to the unfortunate patient than removal of the paralysed limb. I shall have no hesitation, however, in performing the operation as soon as a suitable case presents itself.

In the knee the transverse incision dividing the ligamentum patellæ is usually adopted, whilst in the ankle the anterior incision from one malleolus to the other appears to be preferable to the external or internal lateral, or to the posterior incisions. The line of incision, in each instance, must be planned to meet the requirements of the case, care being taken to suture the various tendons and ligaments which have been divided when the operation is completed. The cartilage covering the articular surfaces of the bones is gouged away, but there is no need to remove the synovial membrane. The joint is fixed in a plaster-of-Paris case for six weeks or two months after the

operation until the anchylosis is complete, and as the joint is not diseased every effort should be made to secure union by first intention, and no drainage-tubes should be employed. In cases of flail-leg, both the knee and ankle joints may have to be abolished before a useful limb is obtained.

SCURVY.[17]

Ætiology.—Scurvy is a rare disease, occurring at any time after a child is four months old, and most often about the age of nine months. It appears to be the result of feeding children upon patent foods and artificially sterilised milk. It is therefore a little more frequent in the children of well-to-do parents than of paupers.

Symptoms.—Scurvy is likely to be mistaken for the subacute form of osteomyelitis, for the stress of the disease falls upon the bones. It is not an infective disease, however, and it runs a widely different course. The onset is usually gradual; the child loses its appetite, it is averse to moving, and lies quietly in its cot with its legs and thighs drawn up. Presently it becomes peevish, and any movement appears to produce the greatest pain. It is dusky and pallid, and it wastes rapidly. The gums may bleed or there may be passive hæmorrhages from the nose or beneath the skin, and yet it is not a bleeder, for there is no hereditary history, and the joints are unaffected. Sooner or later one or more of the limbs becomes exquisitely tender, and the legs more often than the arms. Examination of the tender spots shows that in young children they are usually situated close to the epiphyses, but in older children they may be at any part of the bone. The swelling gradually increases in size and in extent, until the whole bone may be encased in a hard cylinder. This swelling may involve all the bones in

both legs and thighs equally or unequally, or it may affect only a single bone. The scapulæ, the bones of the skull, and more rarely the bones of the face, are affected in a similar manner. The skin is tense and shining, but it is generally pale, and does not feel unduly hot unless the affected bone is quite subcutaneous. There is a varying amount of œdema. The disease usually lasts many weeks, and during this time the temperature is very erratic, though it rarely rises above 101°–102° F. Mr. Holmes Spicer describes a sudden proptosis as a feature in some of these cases, though this symptom has not been marked in any of those which have come under my observation; whilst Dr. Wallis Ord has observed an extensive subcranial hæmorrhage. The protrusion of the eyeball, which is accompanied by puffiness and very slight staining of the upper lid, soon becomes bilateral, the ocular conjunctiva either being a little ecchymosed or else quite free. Spontaneous fractures are peculiarly liable to occur. The fracture is either a separation of the epiphysis, or more rarely it is a true fracture through the shaft (fig. 18). It generally occurs without any marked symptoms, and the first sign of its presence is an everted and helpless limb. Dr. Barlow says that the sternum, with the adjacent costal cartilages and a small portion of the contiguous ribs, sometimes appear to have sunk back bodily as a result of these changes; but this condition I have never happened to see.

Morbid Anatomy.—Many of the children affected with scurvy die, and the autopsy reveals the presence of extensive extravasations of blood beneath the periosteum of the affected bones, as well as an undue loosening of the periosteum throughout the skeleton. The swellings subside slowly when the child recovers, and the tenderness lessens. The power of voluntary movement is regained, and the broken bones repair.

Diagnosis.—The disease has to be distinguished from septic osteomyelitis, from rickets, from congenital syphilis, and from the œdematous condition into which marasmic children sometimes pass. Rheumatism, hip disease, sarcoma, and infantile paralysis can hardly be mistaken by the most careless observer for scurvy.

The chronic nature of the disease and the absence of signs of septic infection distinguish scurvy from osteomyelitis. The recurrent symptoms, such as the gradual onset in winter months, the cachexia and extreme anæmia, the marked languor, the sponginess of the gums and foul breath, the pain, the ecchymoses and the hæmatomata, will serve to distinguish scurvy from rickets, from rheumatism, and most other forms of disease.

Treatment.—The effects of treatment are very remarkable, and the child often makes a speedy recovery, even from the worst conditions. The diet suitable to the age of the patient should be given, but in the ordinary quantity of milk one lightly boiled and mashed potato should be given in twenty-four hours, the number of potatoes being gradually increased if the child relishes the mixture. The juice of a quarter of a pound of lightly cooked steak may also be added to the milk. The judicious administration of a little raw meat-juice is also of the greatest advantage. This is best made by pouring two ounces of cold water upon a quarter of a pound of rump-steak. The beef must be finely scraped, and all the fat should be removed. The beef is soaked in the water for half an hour, or until it is white, and it is occasionally stirred with a fork. The extract is then strained off through a fine gravy strainer. Two or three teaspoonfuls are enough for a child of six or seven months old. The juice of one orange should be administered after each meal, and the child ought to be taken out daily into the open

r as soon as the acute symptoms have passed away. A
ssert spoonful of cream may be given night and morn-
g, to be replaced by cod-liver oil as soon as the patient
n assimilate it. The tenderness of the limbs is best
lovinted by a wet compress.

The local treatment adopted by my colleague, Mr. Picker-
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ssage is useful after the child has recovered, to
event the wasting of the muscles and the stiffness
joints.

Dr. Cheadle has very kindly permitted me to use
e following figures from his work on the Affections of
bones and periosteum in a case of infantile scurvy
ich came under his own notice in the Children's
pital. The specimen is in the museum of St. Bartholomew's Hospital. The details of
e case are published in the *Lancet*, 1878, vol. ii.

FIG. 18.—The bones of the pelvis and lower extremity, showing the changes which occur in infantile scurvy.

[*From Dr. Colcott Fox's specimen in the Museum of the Westminster Hospital.*]

air as soon as the acute symptoms have passed away. A dessert-spoonful of cream may be given night and morning, to be replaced by cod-liver oil as soon as the patient can assimilate it. The tenderness of the limbs is best alleviated by a wet compress.

The local treatment adopted by my colleague, Mr. Pickering Pick, consists "in fixation and perfect rest of the affected limbs, for it must be borne in mind that the blood extravasation is the primary lesion, and that the subsequent fracture probably arises from some slight degree of violence acting on the weakened bone, and therefore every care must be taken by fixing the swollen limbs to prevent this accident taking place. Even after fracture has occurred, fixation is still necessary in order to keep the broken ends in apposition, and to promote union, which in cases that recover seems to take place readily and rapidly, and if attention be paid to position, without deformity. The affected limbs should be bandaged with soft flannelette bandages in such a manner as to fix them in a straight and extended position, and the child should be laid upon a soft pillow to which it can be fixed by a broad flannel bandage passed over the trunk, and on which it can be carried about, and even taken into the open air, with as little movement to its limbs as possible." Massage is useful, after the child has recovered, to counteract the wasting of the muscles and the stiffness of the joints.

Dr. Colcott Fox has very kindly permitted me to copy the annexed figure (fig. 18), showing the appearances of the bones and periosteum in a case of infantile scurvy which came under his care when he was attached to the Victoria Hospital for Children. The specimen is in the Museum of the Westminster Hospital. The details of the case are published in the *Pathological Society's*

FIG. 18.—The bones of the pelvis and lower extremity, showing the changes which occur in infantile scurvy.

[*From Dr. Colcott Fox's specimen in the Museum of the Westminster Hospital.*]

Transactions, vol. xxxviii. The patient was a boy, aged 11 months. He was quite helpless, and he screamed and seemed to be in great distress when he was touched or when any one approached his bed. The somewhat limited physical examination which could be made, showed amongst other things that the carpal ends of the bones of his forearms and the head of the right humerus were enlarged, whilst the tibiæ and fibulæ were broken up as completely as if he had been run over. There were no hæmorrhages into the skin. The temperature was normal when the child was first seen, but it gradually rose to 104·2° F.

The post-mortem examination showed that the right humerus was fractured through the middle third, its upper epiphysis was widely separated by blood-clot, and the periosteum was completely stripped off the shaft in its whole length by an effusion of blood. The left humerus, the bones of the left forearm, and the scapulæ were unaffected. Both ilia were unduly soft and yielding, the cancellous tissue of the right was blood-stained, and the periosteum was separated by hæmorrhage. The crest of the left ilium was loosened. The periosteum of the right femur was completely stripped off by a layer of extravasated blood, and there was a rather irregular oblique fracture of the lower end of the shaft nearly on a level with the epiphyseal line, the ragged ends of the fragments being separated by clot. The right tibia was stripped of periosteum, had both epiphyses completely detached, with irregular splintering of the ends, and a comminuted fracture of the centre of the shaft. The right fibula was in a similar condition; and with regard to the bones of the left extremity, the lesions corresponded exactly with those on the right side.

The earliest indication of tenderness in the bones began

two months before the child was seen, though it had been ailing for six months.

RICKETS.

The deformities resulting from rickets are constantly brought to the surgeon to be remedied, and from his point of view rickets connotes alterations in the bony and ligamentous structures of the body.

Ætiology.—The cause of the disease is unknown, but it often occurs in children fed on patent foods and in those who are suckled for long periods of time by mothers who have been repeatedly pregnant at short intervals. It appears to be due to the failure of the system to assimilate certain substances, either because they are absent from the child's food, or because when present the digestive tract does not absorb them, or the tissues refuse to make use of them. We do not yet know what these substances are; some pathologists hold that the disease is due to the defective assimilation of fat, and others that the absorption of lime is wanting. The first symptoms of rickets generally appear during the teething period; they may appear for the first time in a girl at puberty.

Symptoms.—The intestinal symptoms are usually the first to appear. The child has colic and a tumid belly; it passes more water than usual, and the urine is loaded with phosphates. It sleeps badly, and is restless, often preferring the nurse's arms to its cot. This no doubt is associated with the tendency to cranio-tabes, which is so marked a sign in many cases.

Symptoms of an unstable nervous system also show themselves in convulsions, attacks of laryngismus stridulus or its modified form, when the child has "fits of holding its breath." There is often great vascular dilation coupled with profuse sweating of the head during sleep, or

as a result of excitement, and there is often bony as well as cutaneous hyperæsthesia. The milk teeth are late in making their appearance, and if the child has begun to walk it ceases to do so—"goes off its feet," the mother will say; why, we do not know; perhaps it is the result of general debility; perhaps, as Dr. Lee suggests, it is due to paresis from nerve starvation. This paresis is sometimes so marked that it may be mistaken for a case of pseudo-hypertrophic paralysis.

Pathology.—Rickets produces characteristic changes in the bones and in the ligaments which are of great interest to the surgeon, for they lead to numerous changes requiring operative measures for their relief. The early bone changes are connected with an imperfect formation and consolidation of the bone, both in the shafts and at the epiphyses. The line of calcified cartilage at the epiphysis becomes much thicker than it should be, and as the bone increases in length, long lines of cartilage-cells with imperfectly calcified capsules are left behind in the bone, and so appear to dip downwards from the wide epiphyseal line into the newly formed bone. The new bone is imperfectly formed, its tissue is loose and spongy, and a process of absorption takes place in it leading to the formation of spaces filled with abnormal marrow. The same changes take place beneath the periosteum of the shaft, and the bone has its constitution so radically altered that it becomes soft and pliable, whilst at the same time the epiphyseal line is so much thickened as in itself to give rise to a deformity.

Course.—These changes in the bone lead, after a longer or shorter period, to alterations in the skeleton which are liable to become permanent. The head becomes square, its crown depressed, and the fontanelle is not closed by the fifteenth or sixteenth month, as it should be in a healthy

child. The face has the ill-developed appearance so often seen in the factory hands of our large towns; the teeth are cut late, and appear at long intervals, they are often notched and soon become carious. They are misplaced, for the jaws are malformed. The vertebral column becomes altered in shape, partly owing to changes in the bones, and partly owing to yielding of the ligaments, so that various forms of curvature are produced, often antero-posteriorly, sometimes laterally with concomitant alterations in the thorax. The spinal column may be curved both laterally and antero-posteriorly. The primary curve in the ricketty lateral curvature is more often to the left than to the right. The pelvis is so altered that there are important modifications in the length of its diameters, a change of great importance in the female. The long bones, including the clavicle, become bent in various directions, usually in that of their normal curves. They break as a result of any slight violence, they may become curiously twisted, or their epiphyses may separate. Alterations also take place at the knee-joint leading to one form of genu valgum, and in the spine causing lateral curvature. These conditions are more fully described on pages 207 and 216.

Sooner or later, if the child survives the diarrhœa, and does not die from bronchial catarrh passing into bronchitis or with cerebral symptoms, progressive changes take the place of the retrogressive changes in the tissues. The bones, at first softer, now become harder than usual. Those which have been bent acquire a buttress along their concave surfaces by the condensation of the newly formed inflammatory products, and the bone itself shares in the sclerosis. The epiphyses unite, and leave dense and stunted bones which are permanently deformed. The method by which these changes are brought about are as yet only

imperfectly known. Their study would well repay any one who chose to devote himself to the subject.

Diagnosis.—Rickets has to be distinguished from many forms of digestive and nervous disturbances, from tuberculous, syphilitic, and scorbutic affections of the bones, and from simple marasmus. When it affects the spine, it is particularly likely to be mistaken for caries. The curvature in rickets is less persistent, and is abolished by extension of the trunk (see fig. 9, p. 79). The muscular rigidity is less, and not so lasting; the pain is less acute, and it does not occur in paroxysms; but the child is peevish, and has not the intervals of comparative happiness which mark the course of Pott's disease.

Treatment.—The treatment of rickets is constitutional for the improvement of the general health, and local for the cure of the deformities. The general treatment of rickets resolves itself into doses of rhubarb and soda for the purpose of improving the child's digestive powers. It should be fed at regular and stated intervals. Starchy foods, in the form of corn-flour and milk-puddings, are to be given in small quantities at a time. Fats in some cheap form, as margarine, suet, dripping, and frizzled bacon or sardine oil, are often palatable when the more expensive forms are not available or are not relished. The administration of small doses of cod-liver oil is advisable after each meal. It may be given in combination with minute proportions of phosphorus, either as phosphates or as the element itself, $\frac{1}{150}$ of a grain being a full dose for a child of two years old. Neither drug should be persisted in if it is found to increase the digestive disturbances to which the child is subject. Plenty of milk should be given, and cream diluted with water is often taken greedily. The child must be kept under the best hygienic conditions, and the patient is easily kept warm at night,

when he is apt to catch cold from throwing off the bedclothes, by making him sleep in loose flannel pyjamas provided with feet. He should be douched every morning in a tepid bath of salt water, if this proceeding is followed by a good reaction, and he should have plenty of fresh air and good food. Care must be taken to prevent any exaggeration in the tendency to curvature of the bones or spine by not allowing him to assume improper positions, and the child's legs may be strengthened by the judicious application of light and jointed steel supports passing into the sole of the boot and along the outside of the leg to a pelvic band (fig. 19). These supports are especially indicated in children from one to three years of age, for operative measures are not generally required until the bones have become consolidated in their faulty positions. The operative treatment is considered in the next section.

KNOCK-KNEE.[18]

Ætiology.—Genu valgum, or knock-knee, is one of the commonest of a group of deformities caused by rickets, though the condition is acquired later in life as a result of various ligamentous and muscular changes. Ricketty knock-knee is bilateral, whilst the acquired form is generally unilateral. The ricketty form is the result of changes taking place at the lower end of the femur, combined with some curving of the shaft of the femur or tibia. Sir George Humphrey has recently and ably defended the thesis that the condition is due to stunting of the outer condyloid part of the femur, due to the fact that it is the weight-bearing portion of the bone. Most pathologists attribute it to undue growth of the internal condyloid portion of the femur, and they are no doubt partially correct. The ligaments of the joint are scarcely altered. Knock-knee in older subjects is, with

or without curvature of the lower part of the shaft of the femur, undoubtedly due to changes in the lateral and intrinsic ligaments of the knee, and at a later period in the muscles, the bones only becoming secondarily modified in very long-standing cases. Flat-foot is sometimes a predisposing cause.

Symptoms. — Bilateral knock-knee is noticed in children who are manifestly ricketty soon after they have learnt to walk. The signs are more obvious than the symptoms. If the knees are made to touch each other when the child is lying down, it will be found that the ankles are widely separated, and the interval between the two internal malleoli is the measure of the deformity. The lateral movement in the knee is too free, owing to the stunted growth of the outer condyle, and there is an exaggeration in the normal movements of the joint. There is usually a well-marked projection of bone upon the inner side of the joint, partly due to the internal condyle of the femur, and partly to the upper end of the tibia. This prominence disappears when the knee is flexed. The patella is displaced outwards to a greater or less extent.

Treatment.—The treatment of genu valgum and ricketty deformity of the legs by operative measures is of daily occurrence. It is not necessary, however, to adopt it in every case, for in young children the bones are often sufficiently pliable to enable the deformity to be gradually remedied by the application of suitable apparatus (see fig. 19), whilst with better-class patients a pony may be recommended for the boys to ride. In the later stages of rickets when the bones are dense, and in the very extreme cases of genu valgum, an operation is imperatively called for, and it is only wasted time to delay its performance. The operations in ordinary use are those of osteoklasia and osteotomy.

OSTEOKLASIA is of two kinds, either by forcible straightening,[18] or by means of the osteoclast. Mr. R. W. Murray has performed the operation of forcible straightening no less than 311 times in 1893, and it was extensively performed by the late Mr. Walter Pye. It has been largely employed by the French and Italian surgeons. I have

FIG. 19.—Outside splint with pelvic band and lateral attachments for use in the slighter forms of knock-knee.

adopted the treatment in a few cases, and always for children under 8 or 9 years of age whose bones seemed pliable, but I have never been able to acquire the knack of cracking the denser bones without using what I consider to be an undue amount of force, and I have therefore of late years given it up in favour of osteotomy.

The technique of forcible straightening is easy to de-

scribe, but there is a certain knack of breaking even the most compact bone, which is only acquired by practice and cannot be communicated by words. In an anterior curvature of the tibia the bone is fractured laterally, and it may be necessary to divide the tendo Achillis to enable the lower fragment to be brought into good position. In forcibly straightening a knock-knee, the thigh is grasped firmly about two inches above the patella, and the surgeon, using his index finger supported by his other fingers as a fulcrum, holds the thigh perfectly steady and gradually straightens the limb till the bone yields, the knee-joint being kept over-extended the whole time. The usual point of fracture it is stated almost invariably takes place where the lower end of the femur joins the shaft, and quite an inch above the epiphyseal line, so that there is no danger of injuring the epiphysis, and so of interfering with the subsequent growth of the limbs. Barbarin, however, has recently devoted his attention to the exact seat of rupture in cases of forcible osteoklasia, and he has demonstrated by the examination of specimens that in some cases the line of the epiphysis is actually involved. The leg and thigh should be put up in a plaster bandage for three weeks after the operation.

Ricketty bones are sometimes broken by means of the osteoclast. I have often seen the method employed, but it has always seemed to me to be barbarous, and to be a confession of weakness on the part of the surgeon that he had not perfect trust in his ability to keep the wound aseptic.

It is a method which might perhaps be recommended in private cases, where the sanitary conditions and surroundings were not all that could be desired; but even in such cases it would be unsatisfactory, on account of the after-pain, which is greater than that occurring after forcible straightening or after osteotomy.

OSTEOTOMY is either linear or cuneiform. Linear osteotomy is performed for genu valgum, ordinary ricketty curvature, and at the neck of the femur in cases of anchylosis in bad position as a result of hip disease (see p. 124). Cuneiform osteotomy consists in removing a wedge from the tibia for the cure of ricketty bowed legs when the curvature is directed forwards.

(1) *Linear Osteotomy.*—Some modification of Macewen's operation is usually performed for the cure of the more advanced forms of knock-knee in children over five years of age. The limb is rendered aseptic in the usual manner, on the day before the operation, and is wrapped in a gauze dressing. An anæsthetic is given on the following day, the dressings are removed, and the skin of the knee and thigh are thoroughly washed with perchloride of mercury solution 1 in 1000. The leg is slightly flexed and laid upon its outer side on a wooden block covered with absorbent cotton wool freshly wrung out of the solution of perchloride of mercury. The operator then feels for the well-defined inner border of the femur, and after making the skin tense with the finger and thumb of his left hand, enters his scalpel longitudinally about half an inch above the upper border of the internal condyle. The scalpel is carried on until it reaches the bone after the periosteum has been divided, and an incision is made of sufficient length to allow the osteotome to be entered. The scalpel is now transferred to the left hand without withdrawing it from the wound; the osteotome, an instrument whose cutting edge is bevelled upon both sides and blunt laterally, is then taken up and is passed into the wound along the side of the scalpel, until its edge is felt to be in contact with the bone. The scalpel is immediately withdrawn and a pledget of lint soaked in the antiseptic lotion is held round the osteotome at its point of entrance to

prevent the access of air to the wound. The osteotome is next turned transversely, so that its cutting edge lies across the bone at right angles to the shaft. Its head is then repeatedly struck with a wooden mallet, the osteotome being held firmly in the fingers of the left hand, whilst it is steadied by the extended thumb, until it is felt to have entered the bone for some distance.

Bones vary greatly in their density, so that the force used must be regulated in accordance with the requirements of the individual case. The surgeon soon learns to distinguish when he has passed through the compact tissue on the inner side of the bone, and has come to the cancellous tissue in the centre. He should withdraw his osteotome as soon as he meets with the resistance offered by the compact tissue on the outer side. An endeavour is then made to fracture the bone by seizing the leg in one hand and the thigh in the other, keeping the pad of wool over the wound with one thumb. A sudden wrench is usually enough to complete the division. It should be the surgeon's object not to enter the osteotome more than once; but if the bone does not yield, it is better to replace the instrument than to use an unjustifiable amount of force in endeavouring to fracture the bone. It is not generally necessary to insert any sutures, as a half-inch skin incision is amply sufficient for the entrance of the osteotome, and I think it is better not to irrigate the wound. The wound is at once dressed with a pad of wet gauze, and the ordinary antiseptic dressings are applied.

A flannelette bandage is then applied from the foot, up the leg and over the knee, and a plaster case is fitted from just above the ankle to the fork of the thighs. The case is usually made by cutting a piece of ordinary house flannel of two thicknesses and placing a layer of lint upon its inner side. The shape is represented in the diagram (fig.

20), the side *ab* corresponding to the length of the limb, and *ac*, *bd* to its circumference at the thigh and ankle respectively, the piece below *bd* being the foot piece. The inner lining of lint is sufficiently large to allow of its being wrapped over the edges of the flannel. The flannel is saturated with plaster-of-Paris paste made by mixing one pound of freshly burnt plaster with one pint of water, the excess of plaster being wrung out of the case. The lining of lint is then put in, and the case is bandaged on

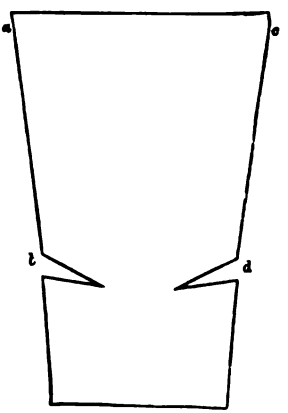

FIG. 20.—Diagram of plaster case for use after osteotomy of the femur for genu valgum, or after a cuneiform osteotomy of the tibia.

to the limb. The limb must be held firmly until the plaster has set, that is to say, until it gives a metallic ring upon being struck, and whilst it is setting the thigh must be pulled outwards whilst the leg is pushed inwards, so as to completely overcome the position of knock-knee. Much of the after-success of the operation depends upon the effectual performance of this simple manœuvre.

The dangers of the operation in children are not great; and although I have performed it many dozen times, I

have never yet got into serious trouble. Sometimes there is sharp arterial bleeding when the scalpel is entered, either because the incision has been made too high, or from the division of some branch of the anastomotica magna or superior internal articular branches; the bone may be unduly vascular in other cases, so that subsequent oozing may require the dressing to be changed and firmer pressure to be applied. The popliteal artery is not likely to be injured if a narrow osteotome be used, and its edge be carried more towards the front than the back of the bone whilst the section is being made.

The after-treatment is of the simplest: the child is kept flat upon its back in bed for three weeks without any change of dressing, unless it has been accidentally soiled, or unless the temperature rises.

(2) *Cuneiform Osteotomy* has to be performed much less frequently than linear osteotomy, as it is only required in the most pronounced cases of anterior bowing of the leg, and when division of the tendo Achillis has been ineffectual in allowing the curvature to be overcome; the result of the operation is, however, most satisfactory, as may be seen in the annexed drawings (figs. 21 and 22), made from photographs of the same patient. The operation is performed with the same antiseptic precautions as in the previous case. A two-inch incision is made immediately to the inner side of the shin at the point of its greatest convexity. The periosteum is divided, and is carefully separated from the inner and outer borders of the tibia, transverse incisions being made through it at the upper and lower margins of the wound. The periosteum, and with it the skin and tissues covering the shin, are then retracted upon either side. A bone chisel is applied with the flat side to the upper part of the tibia, and is made to divide the anterior and the inner surfaces of the

bone by repeated blows upon its head with a mallet until the medullary cavity is reached. The bone is again cut at the lower border of the wound, and a wedge can then be extracted with a strong elevator. The remainder of the tibia and the fibula are then fractured forcibly, and the leg is brought into good position; or, if this cannot be done, more bone is removed until the surgeon is satisfied

Fig. 21.—Ricketty deformity of the tibia.

Fig. 22.—Legs of the same patient after the performance of cuneiform osteotomy.

[*From a patient who was subjected to cuneiform osteotomy.*]

with the result. The wound is then thoroughly flushed with a 5 per cent. solution of boric acid, any sharp spiculæ of bone are removed with cutting forceps, the edges of the periosteum are brought together, but it is unnecessary to suture them, and the wound is closed with horsehair sutures. Antiseptic dressings are applied, and the leg is put into a plaster case (fig. 20) and is held straight until

the plaster sets. The child is kept in bed for about three weeks. Union takes place by first intention if care has been taken to perform the operation subperiosteally, not to bruise the periosteum, and to keep the wound aseptic. The only complication likely to occur is a sharp hæmorrhage from the nutrient artery of the tibia; this stops, however, as soon as the bone is completely fractured.

SCOLIOSIS, OR LATERAL CURVATURE.

Ætiology.—Lateral curvature is essentially a disease of young adult life, and is more common in girls than in boys. It is due to a variety of causes. In a few cases it is congenital, in others it is supposed to be the result of habit, but on inconclusive grounds. It is often a manifestation of rickets, but it is most frequently secondary to alterations in the long axis of the body, and so is compensatory to other conditions. Under this head come the paralytic form, lateral curvature associated with paralytic affections involving the muscles of one side of the back, that seen in tuberculous affections of the vertebræ, and of the hip, or after knock-knee, or in deformities of the pelvis and hip, in wryneck, and as a result of a cured empyema. Rickets is practically the only cause of lateral curvature during the first few years of a child's life; and the primary curve in these cases is a little more common upon the left than upon the right side.

Morbid Anatomy.—In a typical case of lateral curvature the spinal column presents a marked curvature to the right in the dorsal region, and a compensating curve to the left in the lower dorsal and lumbar region. The curve, however, varies as greatly in its position as it does in its extent, and the primary curve may be to the left, the secondary curve being upon the right. The vertebræ

themselves become greatly modified, for in the more severe cases their anterior surfaces face towards the convexity of the curve, whilst the spinous processes maintain their normal relations better, so that the curvature is much more marked anteriorly than posteriorly. There is considerable doubt as to the exact nature of the torsion in these cases, most pathologists maintaining that it is due to modifications in the vertebræ themselves, whilst some hold that it is due to a rotation of the vertebral column as a whole; and others think that it is only an exaggeration of the tendency towards spiral growth which characterises so many animal and vegetable organisms. As a result of these changes, the transverse processes and the ribs on the convex side are separated from each other and are directed backwards, whilst upon the concave side of the curve they are crowded together and look forwards. The intervertebral fibro-cartilages undergo similar changes, or they become wedge-shaped, the thin edge of the wedge being directed towards the concavity of the curve, whilst the ligamenta subflava are shortened along the concavity. The anterior common ligament also undergoes considerable changes, but the posterior common ligament hardly changes at all, even in the most severe cases.

The thorax also becomes modified, owing to the changes in the vertebral column, the net result being an increase in the size of its cavity upon the convex side and a contraction upon the concave side. In severe cases a portion of the thoracic cavity actually lies behind the plane of the vertebral spines upon the convex side of the curve.

Symptoms.—The first symptom to be noticed is that "the shoulder-blade grows out," or that the patient carries one shoulder, generally the right, higher than the other, or that his right hip is more prominent than his left. In some cases the right side of the chest seems to

be more fully developed than the left. The subjective symptoms are ill-defined, and generally a sense of weakness is alone complained of, or there may be neuralgic pains due to pressure upon the spinal nerves at the intervertebral foramina. A thorough examination of the spine must be made in all suspected cases. It will then be found that the curvature can be classified into three groups. The first, in which there is a simple weakness of the back, and although there is a primary curve, no compensatory condition has yet been produced. In these cases the curvature readily disappears when the child lies flat, or when it is supported by placing the hands under the armpits, or when it is made to bend forwards. In the second stage the curvature is diminished when the patient's vertebral column is supported, but it does not entirely disappear. In the third stage the curvature is permanent, and compensatory changes have taken place. The third and worst form of scoliosis is often accompanied by symptoms due to the alterations in the thorax. The breathing is short, the patient may be subject to bronchitis and pneumonia, and there may be serious vascular disturbances culminating in dilatation of the right ventricle. Secondary changes in the abdominal and pelvic viscera are by no means infrequent.

Diagnosis.—Scoliosis is more liable to be overlooked than to be mistaken for any other condition. Pott's disease and simple weakness of the spine are, however, occasionally assumed to be cases of scoliosis. Weakness of the spine practically presents the same changes as the first stage of lateral curvature, though the pathology is not identical, for in weak spines there is no rotation of the front of the vertebræ. The two conditions are distinguished from the second stage of scoliosis by making the patient bend downwards with the knees straight and

the arms outstretched until the finger-tips touch the floor. The scoliotic curve will remain, whilst the curvature of weakness disappears. In Pott's disease the curvature is rather a deviation of the entire body to one side than a sinuous condition of the vertebral column. The bending of the trunk is usually towards the right side, and it is more perceptible when the patient is looked at from before than from behind.

Prognosis.—Scoliosis varies greatly in the course which it pursues. The curves usually develop slowly and almost imperceptibly; sometimes, however, they attain their full development in the course of a few months, and sometimes they remain stationary. The process generally terminates with the cessation of bony growth, that is to say about the twenty-second to the twenty-fifth year.

Treatment.—The treatment is either prophylactic or curative, and it should always be causal if possible. Prophylactic treatment consists in improving the general health, in correcting faulty or unilateral movements of the spine, and in strengthening as far as possible the ligaments and muscles of the vertebral column by shampooing, and gymnastics carried out under intelligent supervision. The patient should be made to rest in the painful forms of the disease. In the slighter forms she may be directed to lie flat upon her back upon the floor or upon a hard, firm couch for a certain length of time daily, the time to be spent in reading by holding her book above her. Ling's system of Swedish gymnastics may also be tried with good effect in these slighter cases, whilst in the more severe forms the patient should lie upon the affected side, which is supported in a sling consisting of a broad webbing bandage, so adjusted that the weight of the body may serve to straighten the curves.

Mechanical means must be adopted if the curvature

progresses in spite of these slighter measures. The appliances are manifold, and range from a simple diagonal bandage to the most complex and expensive jackets. The consideration of these forms of apparatus belongs strictly to orthopædic surgery. The chief points to be borne in mind are that they should be as light and as simple as is compatible with utility, that they should not be employed to the exclusion of other methods, and that in every case the treatment should be carried out upon physiological principles, for lateral curvature is essentially an interference with the normal processes of growth, and is not in itself a disease. Lorenz has recently advocated forcible straightening in advanced cases of lateral curvature, with the application of a plaster-of-Paris jacket which is capable of easy removal, and is appropriately padded, to obtain diagonal compression of the thorax. The jackets are put on with the body sufficiently extended to overcome the curvature.

WRYNECK.

Torticollis is that condition in which the head is held either permanently or intermittently in a condition of unilateral abduction, the chin being turned to the opposite side, and being at the same time a little elevated. The condition is congenital or acquired, primary; or a symptom of some other affection.

Congenital Wryneck.

Ætiology.—The congenital form is due to congenital shortening of one sterno-mastoid muscle, perhaps connected with defective development of the cervical vertebræ, with errors of intra-uterine position, or as Mr. Golding-Bird supposes, with a central brain lesion—acute polio-

encephalitis—akin to acute infantile paralysis. It is far more frequent upon the right than upon the left side, and may be associated with defective development of one side of the face.

Diagnosis.—The wryneck in its slightest forms is often better recognised by looking at the patient's reflection in a mirror than by direct observation.

Treatment.—The treatment consists in dividing the sternal attachments of the shortened muscle, and the subsequent application of some form of elastic apparatus to keep the head straight.

Acquired Wryneck.

Ætiology.—Acquired wryneck may be the result of cicatrisation after extensive burns, or from the contraction of the fasciæ beneath the skin as a result of various inflammatory conditions. It is occasionally produced by primary contraction of the fasciæ of the same character as Dupuytren's contraction of the palmar fascia, or it may be a purely muscular change connected either mainly with the sterno-mastoid itself, or less frequently with the platysma. The muscular contraction may be due to local causes affecting the muscle itself, or it may be due to nerve injury, to nerve irritation, or to inflammatory conditions of the parts near the muscle, as in cases of enlarged glands. Acquired wryneck due to muscular spasm is sometimes a sequel of typhoid, scarlet fever, diphtheria, or malaria. New growths in the sterno-mastoid and injuries of the muscle may produce wryneck by leading to its fibrous degeneration. In other cases the wryneck may be due to paralytic changes in the muscle of the opposite side, or it may be a symptom of cervical caries; but this form can be readily recognised by the fact that the chin points towards the affected sterno-mastoid,

whilst in the other forms it points away from the muscle. The contraction of the trapezius, of the splenius, and of other muscles of the back of the neck sometimes produces various modifications of wryneck. The prognosis depends very much upon the cause.

Treatment.—In the mildest forms of wryneck, some form of elastic apparatus is alone necessary, and Mr. Golding-Bird's method is a good and useful one. It consists of "a rubber door-spring attached above to a webbing head-band laced round the crown of the head and below to a stout hook sewn on to a pair of stays, temporarily worn for the purpose. The rubber spring has lengths of tape at its ends whereby it is fastened, and by means of which the tension can be regulated." The tension apparatus need only be worn during the day; and if this be done for two or three months, a cure may be effected.

In more severe cases, however, much more prolonged treatment is necessary. When the contraction of the sterno-mastoid is slight, and the wryneck is obviously due to it alone, division of its lower attachments affords excellent results, if care be taken to keep the head erect during the process of repair. The muscle is divided either by the open method or subcutaneously; personally I prefer to perform the operation subcutaneously. The child is anæsthetised, its neck is exposed upon the affected side, and the two origins of the sterno-mastoid are separately divided from behind forwards, the knife being entered upon the inner side in each case, and the cut being made obliquely downwards towards the clavicle. The division of the muscle is very often followed by a rumpling of the deep fascia, which may lead an inexperienced operator to suppose that he has not completely divided the muscle. He should not, however, be tempted

to enter his tenotome a second time, though many surgeons recommend the complete division of the deep fascia in all cases where it is deemed expedient to resort to tenotomy for the cure of wryneck. Care must be taken

FIG. 23.—Lorenz's head-swing for use in cases of wryneck.
[*From Hoffa's "Lehrbuch."*]

to ensure asepsis, and the two punctures are closed with cotton wool soaked in collodion.

A bandage is put on, and the head is at once placed straight, or it is pulled a little over to the opposite side,

and is secured in that position by means of a plaster case passing round the thorax and across the head at the forehead. This is left in position for eight to ten days before it is taken off, and by that time the wound will be healed. Some fixed support capable of regulation will be required, and it must be supplemented by the use of the head-swing (fig. 23), shampooing, and gymnastics. The cheapest form of head support is made by moulding two collars of poroplastic felt, one across the top of the shoulder to form a tippet, and a second over it round the neck in such a manner that its rounded edge takes a purchase beneath the jaw, and thus supports the neck in an erect position. If it be considered desirable, the support can be made of leather, and the two collars may be connected together by a special spring to maintain constant traction in the required direction. This forms the essence of Weinberg's apparatus, but I do not find that it is very serviceable in effecting the purpose for which it is constructed.

CHAPTER X

NON-TUBERCULOUS FORMS OF ARTHRITIS

TRAUMATIC ARTHRITIS.

SIMPLE traumatic arthritis, whether due to injury or to perforating wounds of the joints, presents the same symptoms, runs the same course, and requires the same treatment as in adults. The prognosis, however, is rather better in children than in adults, and when suppuration occurs there should be no hesitation in laying the joint freely open and thoroughly draining it.

HYDROPS ARTICULI.

Hydrops articuli of a very chronic form sometimes occurs in the knees of children without any obvious cause.

Ætiology.—The prolonged swelling sometimes leads to the protrusion of herniæ of the synovial membrane, and is sometimes associated with dilatation of the deeply seated bursæ. I believe that such cases are generally tuberculous in origin (p. 127), though in other cases they are perhaps associated with that group of symptoms known as osteo-arthritis (p. 227), for this disease is occasionally met with as a pathological curiosity about puberty.

Treatment.—The fluid may be removed by an incision carried along the side of the joint if asepsis can be ensured, when the joint shows symptoms of weakness, or when there are other pressure symptoms of importance. The wound should be sutured with horsehair, dressed antisep-

tically, and the limb should afterwards be kept at rest by the application of a plaster-of-Paris splint until the wound has healed.

SECONDARY INFECTIVE ARTHRITIS.[18a]

Ætiology.—The exanthemata are often associated with joint trouble in children. Scarlet fever, typhoid, measles, mumps, diphtheria, and smallpox may all develop symptoms of arthritis in their course. The inflammation may be a mere neuralgia of the joint, or it may be a true synovitis, either serous throughout, serous becoming suppurative, or suppurative from the beginning. The joints of the lower extremity are more often affected than the shoulder, elbow, or wrist. Spontaneous dislocation may occur as a result of the inflammatory conditions, and this is said to be of especial frequency in the hip. The exact time of the occurrence of the dislocation is often overlooked, as the deformity is masked by the synovial swelling. Where dysentery is common, similar joint affections have been observed in young people.

Treatment.—The treatment consists in keeping the joint at rest and allaying inflammation by the ordinary measures. The joint must be laid open and drained if it suppurates; means must be taken by extension to prevent spontaneous displacement or dislocation, and when it occurs, care must be taken not to overlook it. A secondary dislocation can sometimes be reduced; but if this is impossible, attempts may be made either to form a new joint by employing passive movements, or means may be taken to ensure firm anchylosis according to the joint which is affected. An osteotomy may be required when the dislocation has been overlooked, for anchylosis in a faulty position often results, and the operation is usually associated with

a tenotomy to enable the limb to be brought down so as to lie parallel to its fellow.

OSTEO-ARTHRITIS.

A secondary infective arthritis occasionally assumes a chronic form in children, and leads to a condition which is known for the present as osteo-arthritis. It is seen more often after scarlet fever than after the other exanthemata. Many joints are affected, and the child is quickly crippled by the swelling and pain. The ætiology and pathology of this condition, like that of osteo-arthritis itself, require further study.

Prognosis.—The prognosis is very bad; such children do not recover when the symptoms are well marked, and, unfortunately for themselves and their attendants, do not soon die.

Treatment.—The treatment can only consist of local applications to the affected joints for the purpose of allaying the pain.

GONORRHŒAL ARTHRITIS.[18b]

Acute inflammation of a single joint is occasionally met with in infants who are suffering from purulent conjunctivitis, and in girls who are brought for the treatment of a purulent vaginitis.

Pathology.—These inflammations of a single joint have been shown to occur in those cases in which the pus from the vagina and the conjunctiva contained Neisser's gonococcus.

Symptoms. — Richardière[18b] and Deutschmann have each recorded cases in which one of the large joints became affected with an acute synovitis a fortnight after the appearance of a purulent discharge containing gonococci. The course and symptoms were similar in every respect to those occurring in the gonorrhœal arthritis of adults.

Treatment.—The affected limb should be fixed upon a splint, evaporating lotions should be applied to the inflamed joint, and the source of infection should be removed by curing the purulent discharge as quickly as possible.

SYPHILITIC ARTHRITIS.

Surgeons are so accustomed to see tuberculous inflammation in joints, that they are apt to overlook the various arthritic manifestations of syphilis.

Varieties. (*a*) *Commencing in the epiphyseal line.*—Arthritis, secondary to syphilitic inflammation of the epiphyseal line, occasionally takes place, and it must be treated on the same lines as the succeeding form.

(*b*) *Commencing in the joint.*—The joints in infants are sometimes affected by a syphilitic inflammation commencing in the joint, which may be serous, but is more often purulent. It sometimes attacks only a single large joint, but two or three joints are generally affected. The capsule of the joint soon yields, and extensive diffuse abscesses are formed which may open spontaneously. Good evidence of inherited syphilis is usually available in such cases. The treatment consists in laying the joint open, draining it freely, and giving the child grey powder. Free movement is usually obtained in the joint when the child survives the process of suppuration.

(*c*) *Gummatous Arthritis.* — Syphilitic arthritis also occurs in later childhood, either in the form of a gummatous infiltration of the bone and of the fibrous tissue outside the joint, or as a gummatous synovitis. The disease in either case is extremely likely to be mistaken for tuberculous arthritis; but its rather more chronic course, the slight though marked evidence of syphilis in other parts of the body, and the smaller amount of pain, will generally serve to distinguish the syphilitic from the tuberculous

type of disease. The prognosis is good, except in those cases where the cartilages of several joints are extensively involved; for in these cases the patients die from the effects of the syphilis upon the nervous or digestive systems. The following case illustrates very well the course run by a case of gummatous arthritis, as well as the treatment to be adopted for its cure:—

A boy, aged 14, came under my care at the Victoria Hospital for Children on the last day of January, 1894, to be treated for an inflammation of the right knee. He had diphtheria in September, 1893, and about a month afterwards sores appeared upon his body. He was noticed to be walking lamely about the end of December. His younger brother has had one ankle-joint excised, presumably for tuberculous arthritis. The patient's complexion on admission was muddy, and scattered over his trunk, limbs, and scalp were patches of superficial ulceration covered with thick scales or with black and raised crusts. The voice was husky, but his teeth were healthy, and there was no evidence of keratitis, or of iritis, either present or remote. The glandulæ concatenatæ on both sides of the neck were slightly enlarged. The right knee was affected with synovitis. It measured 12½ inches over the centre of the patella, whilst the left one only measured 10¼ inches in circumference at the same level. There was a little synovial fluid in the left knee. The synovial membrane in both joints appeared to be thickened, and this was especially marked at the sides. The patient occasionally had a little throbbing pain at nights, but unless the knee was moved he did not complain of pain, and he had never felt any starting pains at night.

The boy was brought by his mother, who presented such obvious signs of tertiary syphilis that he was at once ordered

one-grain doses of grey powder, and in ten days' time his complexion had cleared and his voice was less husky. There was also less synovial effusion in the right knee, whilst the left appeared to be healthy. This improvement continued until March 7th, when the patient was allowed to go home with his right knee in a plaster-of-Paris case. He returned on March 26th, complaining of much pain in both knees, with increased swelling. A plaster-of-Paris splint was again put upon each leg. He returned again on April 2nd, with increased swelling of both knees and some synovitis of both elbows, and he then confessed that he had not taken any powders for a fortnight. He was made to understand that medicine was necessary, and was ordered to continue the one-grain doses of grey powder three times a day. His elbows were less troublesome on April 9th, though his knees were still swollen. He was therefore given half-drachm doses of perchloride of mercury with five grains of potassium iodide three times a day, and a week later he reappeared, saying that his elbows were well, his knees better, and that he had not suffered any pain since he had been taking the new medicine. He increased in weight from 64½ lbs. to 71½ lbs. between April 16th and April 30th, and has remained well and at work as an errand boy ever since.

Mr. Clutton first drew attention to these interesting cases; and though they are often associated with interstitial keratitis, this is not always the case, as is shown by the above instance, where the stress of the disease fell upon the skin and synovial membranes, and not upon the cornea and teeth.

(*d*) *Chondro-Arthritis.*—The worst form of syphilitic arthritis is fortunately the rarest, for it does not respond to the ordinary antisyphilitic remedies, and it is practically incurable. It is that form of inherited syphilis

which is seen as one of the later manifestations about puberty. The bones and joints are extensively affected by a rarefying osteitis, with a deposit of caseating material in the cancellous tissue. A similar process takes place in the articular cartilages, and leads to the formation of irregular grooves and pits.

Symptoms.—The condition may be preceded by transient attacks of synovitis, with evidence of chronic inflammation of the long bones. There are usually many other manifestations of syphilis, with evidence of marked intra-ocular lesions.

Diagnosis.—These cases are very likely to be mistaken for cases of tuberculous disease of the bones and joints. They are to be distinguished, however, by their slower progress, by their slighter tendency to fungation, and by their association with other unmistakable signs of inherited syphilis.

Treatment.—These patients are often so completely permeated by syphilis that very little can be done for them. Mercurial vapour-baths, perhaps, afford them the best chance of recovery, with the inunction of 10 per cent. oleate of mercury at the affected joints.

HÆMORRHAGIC DISEASE.

Two definite forms of hæmorrhagic disease occur in children—the one peculiar to the individual, the other characteristic of the family to which he belongs.

(1) *Passive hæmorrhages* are of no very unusual occurrence in newly-born children; but it is only recently that they have been scientifically studied by French and American surgeons. Dr. Townsend, of Boston, has collected a series of cases which show that such hæmorrhages are most frequent from the stomach, navel, intestines, vagina, mouth, and nose. They also occur as bruises beneath the

skin. They are usually seen within the first seven days of birth, the majority beginning on the second or third day.

Prognosis.—The affection is a serious one. Half the cases which die are fatal within the first day, and the remainder within a week. Recovery takes place in the slighter and more favourable cases within nine days. The hæmorrhage is associated with a marked rise of temperature. Its cause is at present unknown, but it is not associated with any injury to the child, and it is quite unconnected with hæmophilia.

Treatment.—Rest, careful feeding, warmth, and minute doses of alcoholic stimulants during the stage of collapse seem to give the best results.

(2) *Hæmophilia* differs from the previous condition in the fact that it is rarely seen before the end of the first year, that it occurs in families, and that in them it is more frequent amongst the males than the females; whilst during the hæmorrhage there is a local, and not a constitutional, rise of temperature. Members of bleeding families are always subjects of great anxiety to the surgeon in whose neighbourhood they happen to live; and, in spite of all treatment, they usually continue to bleed until they either die or Nature herself arrests the hæmorrhage.

HÆMOPHILIC ARTHRITIS.[19]

Symptoms.—Sudden swellings of the ankles, knees, and elbows often take place in children who are known to be "bleeders," or to come of a hæmorrhagic stock. A few years ago I had two brothers who came to me from time to time on account of painful swellings of their knees and ankles. The attacks came on spontaneously; the skin over the affected joints was glazed, shiny, and hotter than

that covering the unaffected parts. There was a good deal of local tenderness, and there was sometimes ecchymosis. Movement in the ankles was impaired, but the knees were free.

Pathology.—The joints in such cases are remarkably injured, owing, as some suppose, to the fact that the blood effused into them maintains its vitality for a long period of time, though this case is inadequate to explain the results. The cartilages become shaggy, and the ends of the bones are lipped and irregular in the manner once thought to be characteristic of osteo-arthritis, but which now appears to be common to all forms of very chronic joint irritation. A greater or less amount of anchylosis with deformity is a frequent result of these changes. The bleeding comes from the capillaries rather than from the large arteries, so that some surgeons hold that operations of urgency are not contra-indicated in hæmophilia.

Treatment.—The surgeon in all cases where hæmophilia is present should warn the child's parents that it is their duty to tell the patient the nature of his disease as soon as he is of an age to understand, for many dangers may thereby be avoided. No styptics should be used to the bleeding point, as they are always useless. Prof. A. E. Wright [19] states that the coagulation time of the blood can be shortened in cases of hæmophilia by the administration of three to five-grain doses of calcium chloride three times a day; and this general treatment may be supplemented by allowing the patient to inhale carbonic acid gas mixed with atmospheric air. The local treatment consists in casing the affected joint in a well-moulded splint of plaster-of-Paris, which can be easily removed. The splint should be applied until the heat and swelling have subsided, but as soon as possible gentle passive movement and shampooing should be adopted. The result of repeated passive

orrhages into the joints is so bad that Prof. König ecently advocated the puncture and subsequent wash- out of such joints with a 1 in 60 solution of carbolic —a method of treatment which I should be very loth opt.

CHAPTER XI

ACQUIRED DISLOCATIONS AND CONGENITAL DISPLACEMENTS IN JOINTS

DISLOCATIONS from injury are unusual in children, partly on account of the elasticity of the capsules and ligaments of their joints, and partly owing to the want of rigidity possessed by the various elements entering into the construction of their skeletons. Secondary dislocations as a result of disease are also uncommon, though partial displacements are by no means rare. Congenital dislocations are occasionally met with.

DISLOCATION OF THE SEPTUM NASI.

Mr. Walsham says that dislocation of the anterior end of the septum nasi from the nasal spine is an exceedingly common result of injury.

Symptoms.—It gives rise to an unsightly red prominence just within the nostril, and usually causes the tip of the nose to turn slightly to the opposite side. It may lead to considerable obstruction.

Treatment.—The most satisfactory method of treatment, he says, is to shave away the superimposed mucous membrane and the underlying cartilage, layer by layer, till the patency of the nostril and the symmetry of the part is restored.

LOWER JAW.

Dislocations of the lower jaw are practically unknown in children, and they do not occur with great frequency in young adults.

Subluxation of the jaw has been known since the time of Sir Astley Cooper. It usually occurs in young people, and is very prone to recur. It appears to be due to relaxation of the capsule, ligaments, and muscles, but its exact pathology is unknown. The exciting causes appear to be yawning or biting upon some hard substance. Dr. Hamilton describes the symptoms in his own case as being a sudden arrest of the motions of the jaw with the mouth about half open, the arrest of motion being accompanied, or more usually preceded, by a sensation of slipping in one of the articulations. The chin is slightly inclined to the opposite side. The condyle may be felt somewhat advanced in its socket, and while it remains in this position the patient experiences some pain. The locking in his case was sometimes upon the right and sometimes upon the left side.

Treatment.—The condyle can generally be made to fall into place by a voluntary lateral movement of the jaw, but occasionally it is necessary to press gently against the chin with the hand.

Prognosis.—The annoyance may cease as the patient becomes older and stronger.

ANCHYLOSIS OF THE JAWS.[20]

Ætiology and Varieties.—Anchylosis of the jaw is by no means infrequent in children. It is bony or fibrous, bilateral nearly as often as unilateral. Its movements are sometimes impeded as a result of cicatrices of the cheek, due to burns and various ulcerative processes. True bony anchylosis occurs after injury to the condyles, as a result

of suppuration involving the glenoid cavity after measles, scarlet fever, or other infective disease, or from the opening of a cervical or retropharyngeal abscess into the joint. A curious spasmodic form is sometimes associated with dental caries, or from the irritation of retained wisdom teeth.

Treatment.—The symptoms are obvious, for there is difficulty, or even absolute inability, to open the jaws, and any attempt at mastication may be accompanied by severe pain.

The treatment is most unsatisfactory. The employment of wedges and the forcible opening of the mouth by gags are cruel and futile expedients, and should not be adopted except in the very simplest cases of fibrous anchylosis. A plastic operation after division of the bands of scar tissue affords some measure of relief when the impaired movement is due to cicatrices.

Operative measures are alone beneficial in cases of bony anchylosis. Many forms of operation have been devised, each with the design of obtaining a false joint either on one or both sides of the jaw, as the occasion requires. The methods of Swain, Esmarch, Mears, and Bottini are said to yield the most satisfactory results. Mr. Swain advises that an incision about an inch and a half in length be made at the angle of the jaw, parallel with it, and taking the angle as the centre of the incision. The knife is carried down to the bone, the soft parts are retracted, and the periosteum, carrying with it the attachments of the masseter and the internal pterygoid muscles, is raised from the outer and inner surfaces of the angle. A narrow saw is then applied, and a wedge-shaped piece of bone is removed. This piece of bone should include the angle of the jaw, and the base of the wedge should measure about an inch. A similar operation may be at once performed

upon the opposite side if the anchylosis is bilateral. The operation is not a difficult one; there is no bleeding, no important structures are likely to be injured if it is performed subperiosteally, good movement is obtained, and the scar is not very perceptible. It is important that union by first intention should be obtained in these cases; for if suppuration takes place, it is very likely that bony union will take place.

Passive movement is begun upon the third day, and is repeated daily for a period of six to eight weeks. Dr. Mears suggests that the use of American chewing-gum is serviceable in these cases to maintain the movements of the jaw during the formation of the false joint. It is often difficult to decide which is the anchylosed side in cases of firm bony union; but in cases of doubt there is a slight springing of the jaw, which is more noticeable upon the unaffected side; it is best marked during mastication. The jaw in most cases is slightly displaced towards the affected side, owing to the absorption of bone and cartilage, which occurs during the process of anchylosis. This displacement is easily detected by noticing the intervals between the incisors in the upper and lower jaws.

SHOULDER.

Primary dislocations of the shoulder are very infrequent in children, and their place is taken by separation of the upper epiphysis of the humerus; but dislocations at the elbow and of the fingers are by no means rare. The signs and symptoms of separated epiphysis have already been given (p. 171).

ELBOW.

Dislocation of the elbow in children is generally due to falls upon the hand with the palm downwards. The radius

and ulna are usually displaced backwards, probably owing to the want of development of the coronoid process of the ulna; though the radius may be dislocated alone, its head being driven forwards.

DISLOCATIONS OF RADIUS AND ULNA BACKWARDS.

Symptoms.—The symptoms presented by a double dislocation of both bones backwards are that the elbow is slightly bent, and is so fixed that it can be moved somewhat more readily from side to side than in the ordinary direction; the hand and arm are moderately pronated; the lower end of the humerus projects forward, whilst the upper ends of the radius and ulna can be felt posteriorly.

It is important to know the relative positions of the olecranon and condyles in a normal elbow, as in no other way can a correct diagnosis be made of obscure injuries in this region. Holden, in his *Landmarks*, says that when the elbow is extended the highest part of the olecranon is never above a line joining the most prominent part of the external and internal condyles posteriorly, but it always lies in this line. With the elbow at right angles, the point of the olecranon is vertically below the line of the condyles. In extreme flexion, the point of the olecranon lies in front of the line of the condyles. In cases of backward dislocation the olecranon lies at a higher level than the internal condyle; but the distance between the acromion and the external condyle of the humerus is identical upon the two sides. An intelligent child will sometimes complain of a referred pain felt along the inner side of its hand, owing to the stretching of the ulnar nerve over the projecting bone, and there may be numbness along the course of the median nerve.

Diagnosis.—A diagnosis has to be made between a

backward dislocation of a radius and ulna and fractures at or near the lower epiphysis of the humerus. This is often very difficult, unless the patient is seen directly after the injury, for swelling soon obliterates all the landmarks of the elbow. Flexion of the arm in a case of dislocation causes the olecranon to become more prominent, whilst in extension the prominence is diminished: the exact contrary of this is observed in cases of fracture at the base of the condyles.

Treatment.—Reduction can generally be effected without using much force, either, according to Sir Astley Cooper's method, by bending the elbow round the knee, so that the radius and ulna are pressed backwards until they are disentangled from the humerus, or by over-extending and then suddenly flexing the arm. The proof of complete reduction is the ability to flex the arm to a right angle. The surgeon should not be satisfied until his patient can do this: for, in a case of separated epiphysis, the deformity will reappear as soon as traction is taken off the arm; and in cases of dislocation it sometimes happens that only one of the two bones is replaced in its normal position, unless the surgeon pays attention to the voluntary power possessed by the joint when he thinks reduction has been effected.

The arm must afterwards be put upon a well-padded rectangular splint, and it should be slung with the points of the fingers directed upwards. The elbow should be covered with an evaporating lotion, and the splint should be removed at the end of a week or ten days, massage and gentle passive movements being then adopted.

Prognosis.—The result is usually good, but anchylosis occurs rather more often after dislocations of the elbow than in other joints. Arthrotomy or excision of the joint must be performed in these unfortunate cases if other means fail.

DISLOCATION OF RADIUS AND ULNA FORWARDS.

Dislocation of the radius and ulna forwards is sometimes seen in children, but less frequently than the preceding form. It is said to be caused by a fall upon the elbow with the arm in a position of forced flexion. It is rather more frequent in children than in adults, and it is often associated with detachment of the internal epicondyle.

Symptoms.—The forearm is shortened and flexed upon the arm when the dislocation is complete, but the forearm is extended in the incomplete forms.

Treatment.—Reduction is effected in the incomplete forms by extension, and in the complete form by flexion first and extension afterwards, the arm being treated in the same way as after dislocation of both bones backwards.

DISLOCATION OF THE RADIUS.

Dislocation of the radius forwards is usually associated with rupture of the orbicular ligament. It may be produced by falls upon the elbow or upon the hand with the arm extended and pronated, or by a direct blow upon the posterior surface. The head of the bone can be felt in its new position, and the tendon of the biceps is relaxed, whilst the forearm is more or less pronated. Flexion beyond a right angle is impossible, as the radius strikes against the front of the humerus. The contraction of the biceps is the chief obstacle to reduction after the injury, and it tends to reproduce the displacement when the head of the radius has been put back into its normal position.

Treatment.—Reduction is effected by first flexing the elbow, and then causing an assistant to extend the arm whilst the surgeon presses the head of the bone into position. The necessary manipulation is generally attended

with success, but the tendency to dislocation is so great that the elbow must be kept bent for at least three weeks.

SUBLUXATION OF THE HEAD OF THE RADIUS.

A remarkable accident sometimes occurs in children which is provisionally described as a subluxation of the head of the radius. It was known to Hippocrates and to Celsus, and was described by Fournier in 1671. Attention has recently been called to it by Mr. Jonathan Hutchinson, jun., and by Mr. Mansell Moullin in England, and by Dr. van Arsdale and Dr. van Santvoord in New York (p. 180).

Ætiology.—The injury always results from some cause which leads a child suddenly to bear its entire weight upon the arms whilst they are fully extended. It occurs in children under nine years of age, but it is most common under six. I have seen the accident result from a fit of temper when an obstinate nurse has pulled in one direction and a still more obstinate child has pulled in the other.

Symptoms.—The child immediately allows the hand to hang downwards, as if it were paralysed. He complains of pain in the wrist, and feels pain on attempting to lift, bend, or extend the forearm. There is no marked deformity of the arm or at the elbow, but the arm is pronated and slightly flexed. Pressure over the head of the radius always causes pain, and voluntary supination is impossible.

Morbid Anatomy. — The cause of the condition is quite unknown, although many theories have been put forward to account for it. It is perhaps associated with a more or less complete displacement of the small and ill-developed head of the radius beneath the orbicular ligament.

Diagnosis.—The symptoms are so characteristic that,

coupled with a history of the injury, they are not likely to be mistaken for either a bruise or a sprain of the wrist or elbow.

Prognosis.—The prognosis is good, for even if left untreated a perfectly useful arm results.

Treatment.— Extend the arm by pulling upon the hand, supinate it, and at the same time press downwards and backwards upon the head of the radius until it has descended to a level with the articulating surface of the humerus. The forearm is then flexed upon the arm, so that the hand passes outside the shoulder, the pressure upon the head of the radius being at the same time vigorously maintained. The arm should then be bandaged to a well-padded rectangular splint for three or four days. The supination appears to be the most important part of the manipulation, and the reduction of the injury is usually effected with a distinct snapping sound and sensation at the head of the radius.

DISLOCATION OF THE PHALANGES.[21]

Dislocations of the phalanges upon each other or at the metacarpo-phalangeal joint occur rather frequently in children, either from falls or direct injuries. They are simple and incomplete, when the phalanx has not left the head of the metacarpal, or they are simple and complete, the phalanx being displaced backwards. Complex forms of backward dislocation also occur in which the phalanx of the thumb is dislocated backwards, but the glenoid ligament with its sesamoid bone becomes turned upon itself, and is interposed between the articular surfaces of the metacarpal and the phalanx in such a manner as to render the dislocation irreducible. I am indebted to Mr. Battle for his kindness in lending me the figures 24 and 25 which show the normal and injured condition of structures at the

metacarpo-phalangeal joint. Faraboeuf thinks that this accident is nearly always the result of ill-judged attempts to reduce the simple complete form.

Treatment.—Mr. Battle,[21] who has paid much attention to these injuries, recommends that the displaced phalanx should be hyperextended and tilted up until its articular

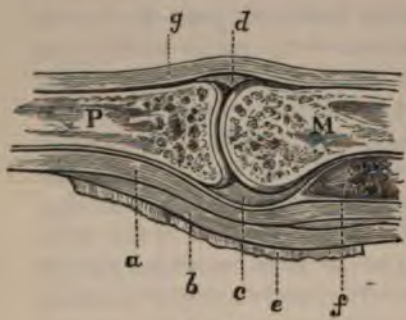

FIG. 24.

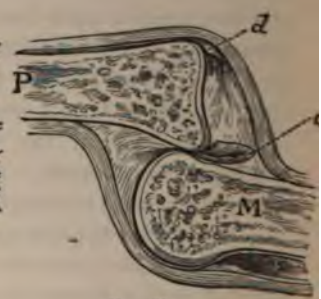

FIG. 25.

Diagrams of the anatomical structures at a metacarpo-phalangeal articulation, before and after dislocation of the joint.

[*From blocks kindly lent by* Mr. *W. H. Battle.*]

FIG. 24.—Section through metacarpo-phalangeal joint (after Henle). *M*, head of the metacarpal bone; *P*, base of the first phalanx; *a*, tendon of the flexor profundus digitorum; *b*, tendon of the flexor sublimis digitorum; *c*, glenoid ligament; *d*, dorsal ligament (absent, according to Gray); *e*, vaginal ligament; *f*, interosseous ligament; *g*, tendon of extensor communis digitorum.

FIG. 25.—Diagram to illustrate the position of the glenoid ligament, antero-posterior section. *M*, metacarpal bone; *P*, phalanx; *c*, glenoid ligament displaced and turned upon itself; *d*, ruptured dorsal ligament, occasionally present.

surface projects anteriorly under the skin. The two fore-fingers should then be placed so as to keep it in position, and pressure should at the same time be made against the distal extremity of the metacarpal bone. Firm pressure of the surgeon's thumb against the base of the dislocated phalanx will then permit it to be pushed into place. The reduction is generally easy, and is accompanied by an audible click. In complex cases the base of the phalanx

should be carried backwards along the dorsal surface of the metacarpal bone, whilst traction is made upon the thumb so as to pull the ligament with its sesamoid bone more fully in front of the anterior margin of the articular surface of the phalanx before flexion.

An anæsthetic must be given if this method fails, and the glenoid ligament must be divided subcutaneously. The tenotome is entered in the middle line and on the dorsum of the metacarpal, so as to avoid the sesamoid bone. If reposition cannot yet be effected, a lateral incision should be made along the joint, and the ligament or flexor tendon must then be replaced.

After severe compound fractures, or when anchylosis of a joint has taken place as a result of an injury, the head of the metacarpal bone may be excised, passive movement being adopted at the earliest possible opportunity.

DISLOCATION OF THE HIP.

Traumatic dislocations of the hip are not of frequent occurrence in children. I have only seen one. The head of the bone lay on the dorsum ilii in a boy of eight years, and it was reduced without difficulty by manipulation. Hamilton records several instances in children from six months old and upwards. The mechanism of production, the varieties, the method of reduction, and the after-treatment are the same as in adults.

DISPLACEMENTS IN JOINTS SECONDARY TO DISEASE.[22]

Secondary displacements of the hip, shoulder, elbow, and knee are of frequent occurrence as a result of chronic or destructive inflammation of the joints, and in exceptional cases true dislocation may occur. One of the great objects in the surgical treatment of chronic arthritis is to prevent

the occurrence of such accidents, or if displacement is inevitable, to minimise its evil results. Displacements of the shoulder and knee are often coexistent with paralysis of the limbs. They are caused by alterations in the muscles, ligaments, and capsule, owing to trophic changes, or they may be produced by alterations in the ends of the bones themselves.

Treatment.—Arthrodesis (p. 195) may sometimes be satisfactorily performed for the relief of this condition; but more usually some form of orthopædic apparatus is employed to render the limb less cumbersome.

CONGENITAL DISPLACEMENTS IN JOINTS.

Congenital displacements have been described in the lower jaw, the ensiform cartilage of the sternum, at either end of the clavicle, at the upper end of the humerus, either backwards or forwards at the wrist, at the fingers, and at the patella. The details of these congenital defects will be found in the works of R. Smith of Dublin, and of Jules Guérin of Paris. Such displacements are rare; they are treated by the use of suitable orthopædic apparatus, and they may be dismissed without further remark. Congenital displacement of the hip and knee stand on rather a different footing. Our knowledge of their pathology, causation, and treatment has been lately advanced, and they may therefore be considered in greater detail.

Congenital Displacement of the Hip.[23]

Morbid Anatomy.—There is no longer any reasonable doubt that congenital displacement of the hip is due to a malformation of the acetabulum, due to developmental errors in its iliac segment. Secondary changes occur in the head of the femur, and it is never caused by injuries at birth, as was formerly maintained by nearly all sur-

ons. The displacement is more often bilateral than ilateral, and in 88 per cent. of the cases it occurs in rls.

FIG. 26.

FIG. 27.

IGS. 26, 27.—Single and double congenital displacement of the hip. The e of single displacement is copied by permission from Mr. Adams' work.

Symptoms.—The defect is not usually discovered until e child begins to walk. Attention is then called to it

by the peculiar gait which is acquired owing to the play of the head of the femur upon the dorsum ilii inside the elongated capsule. This leads to a rolling, waddling movement if the displacement is double, for at each step the body is inclined towards the limb upon which the weight is borne. The physical examination is best made by sitting behind the patient, who has been stripped. It will then be noticed that the buttocks are unduly wide, that the great trochanter is raised above Nélaton's line, and that the child presents the peculiar form of lordosis known as "saddle-back" (figs. 26, 27). Mr. Barwell [23] has recently shown that when the patient bends forward with the knees straight the trochanter on the affected side projects upwards above all the other bony points of the pelvis in an absolutely unmistakable manner. A further examination may next be made in a recumbent position. It will then be found that the affected leg is shortened, but that the shortening can readily be overcome by pulling upon it, though, as soon as the extending force is taken off, the head again ascends and assumes its original position, which is usually above and behind the acetabulum. A slight jerk will often be felt as the femur passes over the surface of the ilium, as though it were moving along an irregular surface.

Diagnosis.—Congenital displacement has to be distinguished from the weak joint associated with infantile paralysis or unnoticed septic arthritis occurring in connection with one of the exanthemata; but, as a rule, there is not the least difficulty in recognising a congenital displacement if attention be paid to the history and to the symptoms.

Prognosis.—The prognosis is at present very unsatisfactory, for no method of treatment has yet succeeded in *giving* a perfect limb, though all methods claim to improve

a condition which in its slighter forms is only inconvenient.

Treatment.—Many methods of treatment have been adopted. They may be divided into operative and expectant. The most recent operative method is that carried out by Lorenz.

The limb being extended, he divides the adductors subcutaneously. Through the same incision the hamstrings are likewise detached from the tuberosity of the ischium. An incision between two and three inches long is then made from the anterior superior spine of the ilium vertically downwards. This enables the operator to divide the fascia lata, tensor fasciæ femoris, the anterior edge of the gluteus medius and the sartorius in a transverse direction. Passing more deeply between the tensor fasciæ and the sartorius, he introduces a director under the tendon of the rectus femoris, which he divides immediately below the anterior inferior spine of the ilium.

The anterior aspect of the capsule having been exposed, the joint is opened by a crucial incision. Extension is now relaxed, the thigh flexed and adducted, and the femur forced upwards so as to bring the head into contact with the acetabulum. At this stage of the operation it is important to divide with a probe-pointed knife a few tense bands from the capsule which are inserted into the neck of the bone. When this is done, the acetabulum can be reached and even seen by separating the edges of the opening. The cotyloid cavity is now enlarged, care being taken to preserve the bony rim intact above and behind, and a little extension brings the head opposite the acetabulum, into which it readily glides. The operation is completed by closure of the external wound, except in its middle part, which remains open. Lastly, an apparatus is applied which maintains the thigh in a position of slight abduction.

This, like all other operative measures, is only indicated for patients between the ages of 4 and 7 years of age, as a cutting operation is difficult and dangerous in older children. Division of the femur below the trochanter is serviceable for older children when there is extreme deformity of the hip with adduction. Hoffa's operation may also be adopted in these cases. The head of the bone is sawn off at the intertrochanteric line in his operation, the posterior part of the capsule is cut away in order to allow of good apposition of the limb, which is then put up in a plaster case in an abducted position. When the displacement is unilateral and only slight in degree, it may be sufficient to conceal the shortening by the use of some form of high boot. Lannelongue's method of sclerogeny (p. 102) is sometimes serviceable when the range of movement is unduly extensive. The treatment of these cases by prolonged rest with extension has found many advocates, either in its simplest form, as has been advocated by Buckminster Brown and by Mr. William Adams (to whose kindness I am indebted for fig. 26), or in its abridged form by division of the tendons and by endeavouring to form a new acetabulum. The method of absolute recumbency for two or three years, followed by the use of instruments to secure the immobility of the hip for a further period of eighteen months, sometimes yield satisfactory results if it be adopted for children of two or three years old.

Congenital Displacement of the Tibia.

Congenital displacement of the knee is less frequent than a similar condition in the hip. Of the twenty-six recorded cases, Hoffa says that fifteen were double, and of the rest nine were on the left side and only two were on the right. *Both* sexes are equally affected, and there is no evidence of

any hereditary predisposition. The tibia is nearly always dislocated forwards, for only in a single instance did it lie behind the femur. There is no difficulty in recognising the condition, though it must not be mistaken for the back-knee, which results from defective growth at the epiphyseal lines, and is often connected with infantile paralysis. Congenital absence of the patella has been noticed in a few cases of congenital dislocation of the knee. The prognosis is good when the affection is unilateral.

Treatment.—The dislocation should be reduced and the leg should be fixed in a plaster case extending above the knee for a week. Massage and passive movement should then be commenced, the splint being removed daily until, at the end of a fortnight, it can be entirely laid aside.

Passive Dislocations of the Fibula.[91]

The upper end of the fibula is *sometimes dislocated*, either completely or incompletely, in children. The head of the bone is usually displaced outwards, and although it is readily replaced, it is as readily dislocated again.

The condition appears to be due to knock knee, when it is only accidentally discovered, or it may result from injury. It may be due to congenital defects, to weakness of the ligaments, or to infantile paralysis of the quadriceps.

The signs are obvious, the symptoms less well defined, for the child walks easily, but as age [illegible]

The treatment must depend upon the cause. The knock knee must be corrected, and it may be necessary to excise any ligaments which have been torn in cases following upon an injury to the knee.

Congenital Displacement of the Patella

The knee-cap is sometimes displaced outwards; [illegible]

always outwards, and is generally associated with knock-knee. Heredity appears to play a great part in its production. Its treatment is unsatisfactory, but an attempt may be made to remedy the defect resulting from the deformity by the application of a light outside iron splint with a pelvic band.

Congenital Displacement of the Elbow.

Congenital displacement of the elbow is very rare. Both bones may be dislocated backwards or forwards, or the radius alone may be displaced, though this is exceedingly rare. Excision, either of the joint or of the head of the radius, may be performed in very severe cases.

Congenital Displacement of the Shoulder.

Congenital displacement of the shoulder is of unusual occurrence, for most of the recorded cases have been met with in adults, and there is reason to suppose that they were of paralytic origin. The dislocation in the undoubted cases has either been of the subcoracoid or subacromial variety, whilst in one of Guérin's cases the head of the humerus was displaced upwards and outwards. Gaillard has seen a girl whose humerus was observed to be displaced a few days after birth. At sixteen years of age she was found to have developed an infraspinous dislocation, with fixation and much wasting of the shoulder. Treatment is ineffectual.

CHAPTER XII

SURGICAL AFFECTIONS OF THE LIPS, MOUTH, TONGUE, AND ŒSOPHAGUS

Harelip.

Varieties.—Harelip is either partial or complete, single or double. It may or may not be associated with a cleft palate, and in cases of double harelip there may be marked alteration in the position and relation of the intermaxillary bones, and of the alæ nasi. In some more rare cases the cleft is median, in others it is a cleft of the lower lip, and in yet others the cleft is lateral and extends into the cheek, constituting a condition of macrostoma. The recognition of harelip presents no difficulties, and the only questions that arise in connection with it are, when and how it shall be cured. Feeble children who are wasting daily in spite of their being able to suck, the surgeon will have nothing to do with; syphilitic babies come into the same category, and so do those who have thrush, diarrhœa, or bronchitis. The operation in each case, however, may be performed as soon as the child's health is restored. Wasting babies are often rapidly improved by forced feeding. This is best effected by passing an inch and a half or two inches of india-rubber tubing to the back of the mouth and connecting the other end with a glass syringe. The syringe, filled with liquid food, is worked rhythmically to imitate the discharge of milk from the nipple.

Time for Operating.—The best time for the operation is during the fourth month, for the child is then strong and well able to bear the loss of blood, whilst it is sufficiently far from the commencement of the teething period to prevent any anxiety on that score. When it is impossible for the child to get sufficient food owing to its inability to suck, and when it is otherwise healthy, it may be necessary to operate earlier; but such cases are very rare, and much depends upon the nurse.

Operation.—The mouth, gums, and nose must be thoroughly cleansed before the operation, by means of small pledgets of absorbent wool soaked in a saturated solution of boric acid. The child is then wrapped up in a sheet to prevent it raising its arms during the operation, and it is anæsthetised. The assistant stands upon the left side of the patient, and takes the lip upon either side of the cleft, between the finger and thumb of each hand, in such a manner as to compress the inferior coronary arteries and so to arrest the bleeding. The surgeon then everts the lip, and with a thin scalpel separates its outer portion very freely from the cheek by cutting through the mucous membrane until the sides of the cleft can readily be approximated; but if possible he leaves the central edge of the cleft and the frænum of the lip untouched. A piece of sponge on a holder is then pressed between the cheek and the bone to arrest the hæmorrhage, and a fresh supply of chloroform is administered to the patient.

The operator then takes a pair of toothed forceps in his left hand, and with the scalpel in his right, he proceeds to pare the edges of the cleft upon both sides, taking care to pare the angle in a simple cleft, and to carry his incision well up into the nose in the complete form. The paring should be liberal, and must include the whole of the red surface of the lip. The edge should be completely cut

away on the central border, but it should not be detached upon the cheek side, where it should be left as a flap.

The edges of the cleft are approximated at once, so that the two borders of the lip are in exact apposition, and a suture of silver wire is passed through the whole thickness of both sides of the cleft, at the point where the two arteries have been cut, to arrest the hæmorrhage. Horsehair sutures are then put into the lip above and below the wire suture, so as to bring the edges into accurate contact. The flap attached to the outer side of the cleft is then brought over the lip upon the inner side, and for this purpose the free border of the lip upon this side has been freshened. It is secured by a horsehair suture. The notch which sometimes appears after the operation for harelip can in this way often be prevented from appearing.

The lip is gently dried, and a piece of cyanide gauze shaped like the figure ∞ is cemented over it with collodion, a piece of strapping being applied over the whole to keep it firm. The wound usually requires dressing on the third day, and it sometimes happens that union is so complete as to enable the sutures to be removed; more often, however, they must be left in position from four to seven days, though it is better to remove them as soon as possible.

Modifications.—The above is the simplest operation, but it is rarely performed in its naked simplicity, for no two cases of harelip are alike, and the surgeon is called upon to exercise his ingenuity as often in this operation as in any other plastic procedure. When the cleft is complete, the nose is often much flattened, and it must be dealt with before any operation is performed upon the lip. Mr. Thomas, of Birmingham, has recently introduced a slight modification in the treatment of these cases, which is often very useful. The first step in his operation consists in restoring the margin of the nostril, by freeing the outer edge of the

ala nasi, and attaching the edge of its cartilage to the columna nasi. An interval is then allowed to elapse until union is complete, and the ordinary operation is then performed.

The most troublesome cases of harelip are those in which the cleft is wide and has uneven margins, or those in which the premaxillæ are displaced; for a double harelip is not necessarily more difficult to close than a single one. The surgeon has to be guided to a certain extent by the necessities of each case, as no hard-and-fast rule can be laid down for the treatment of the premaxillæ. The broad rule is that they must be saved as often as possible, when their retention does not militate against good union of the lip on the one hand, or against the prominence of the alæ nasi on the other. It sometimes happens that if undue force be exerted to twist and maintain them in good position, the tip of the nose may be unduly flattened; whilst, on the other, if they be ruthlessly cut away on every occasion, an unsightly and square upper lip is produced. If the mass is attached to the tip of the nose, it had better be removed after its covering of mucous membrane has been turned downwards to enable it to be utilized at a later stage in the operation.

Krönlein's suture should be employed when the tissue is deficient, when an undue strain is put upon it, or when from any cause union by first intention has failed, and it is necessary to obtain adhesion by granulation. A piece of stout silver wire is threaded through a pearl shirt-button which has been boiled to render it aseptic, its free end is passed with a needle through the cheek just beneath the malar bone, and then transversely across the gum to an exactly corresponding point beneath the opposite malar, where it is threaded to a second button and drawn sufficiently tight to keep the two borders of the cleft in good

apposition. A useful tension suture is thus obtained, and if the silver wire is thick enough, it may be left in position without producing any suppuration until good union is obtained, and it only leaves two pinhole scars which are hardly noticeable.

It is often a mistake to try and do too much at a single operation upon a harelip, for the child becomes collapsed, or unduly weakened by loss of blood, and the tissues do not then repair by first intention. It is better to perform two or three operations in severe cases, and except in the simplest forms, a secondary operation is very frequently required.

After-Treatment.—The after-treatment consists in keeping the child quiet and in not permitting it to cry. It should be fed from a feeding-bottle which allows the fluid to be drawn up easily. Mr. Jacobson and Mr. Wright have both drawn attention to the urgent dyspnœa, even to asphyxia, which sometimes occurs after the operation for harelip. It is due apparently to a valvular action of the lower lip, preventing the entrance of air into the lungs of a child who has not yet learnt to breathe through its nose. The dyspnœa comes on suddenly, and the condition is a relapsing one. It is rare, fortunately, for it is so fatal that each of the three recorded cases died. No child, therefore, who has been operated upon for a harelip, should be left without the supervision of a nurse. She must be instructed to depress the lower lip, at intervals of ten minutes for an hour or two after the operation, to enable the child to obtain plenty of air by its mouth, if it presents symptoms of dyspnœa. She ought also to be shown how to maintain artificial respiration, and she must be told instantly to send for assistance if the child becomes livid.

CLEFT PALATE.

Varieties.—Congenital clefts of the palate may or may not be associated with harelip. Clefts of the hard palate are always associated with clefts of the soft palate; but the soft palate is sometimes cleft, whilst the hard palate is normal. Cleft palate in the early life of a child causes trouble in deglutition, and in later life speech is altered. The earlier difficulties can be overcome by allowing the child to suck from a bottle with a very large nipple, or from one in which the nipple has attached to it a soft metal cover (fig. 28) serving as an obturator, or by careful feeding with a half-decked spoon. The later difficulties

FIG. 28.—Nipple, with flexible metal shield, for the use of infants with cleft palate.

are partially removed by repairing the defect before the child has learnt to talk.

Time for Operation.—The operation should therefore be performed when the child is about three years of age; but the harelip, if it be present, should be repaired at the ordinary time, as its closure appears to exercise some degree of traction upon the two maxillæ, and so prevents undue widening of the cleft, if it does not actually tend to close it.

The Operation.—The tonsils, if they are unduly enlarged, should be removed before the operation is undertaken. The child otherwise needs but little preparatory treatment beyond the ordinary purge and the application of an antiseptic solution to the mouth and naso-pharynx. The

patient is anæsthetised, and is so placed upon the operating table that his head hangs vertically over the end, in the manner recommended by Professor Rose, of Berlin. The table must be arranged to get the best possible light upon the mouth, for it is of the utmost importance that the surgeon should see quite clearly every part of its roof. A skilled anæsthetist is very necessary in cases of cleft palate; for the ease of the operation, and often a great part of its success, will materially depend upon his abilities.

A gag is introduced into the side of the mouth, and the simpler the pattern the better; it is taken charge of by the assistant, who stands upon the left side of the patient, whilst the operator stands upon the right side. He then takes a narrow-bladed scalpel fixed into a long handle, and with it he makes an incision upon either side of the palate, external to the descending palatine artery, and reaching from the anterior angle to the posterior border of the cleft in the palate. The mucous membrane, with its glands and the periosteum, are then raised with a raspatory upon either side, and along the whole length of the incision, so that the two flaps hang loosely, and can readily be brought together along the middle line. This stage in the operation is attended by much bleeding, and it is an important part of the assistant's duty to prevent the blood passing into the trachea; for this purpose he is provided with numerous small pieces of surgically-clean sponge, mounted on holders. The whole depth of tissue down to the bone must be taken up in the flaps, and their thickness is often a matter of surprise.

As soon as the flaps have been detached, a piece of sponge is held lightly against them in such a manner as to compress them against the palate, whilst a fresh supply of chloroform is administered to the patient. The bleeding soon stops, and the surgeon then proceeds to pare the edges

of the cleft. He seizes the extremity of one side of the uvula with a pair of long-handled forceps, and makes one side of the cleft tense. He then enters a sharp-pointed and thin knife, which may be double-edged if he prefer it, close to the margin of the cleft, and pares the whole of one side; the other end of the uvula is then stretched, and the proceeding is repeated upon the opposite side, especial care being taken to freshen the anterior angle of the cleft and the tips of the uvula. Professor W. Rose, of King's College, who has had very great experience in performing the operation, strongly recommends that the mucous membrane should be cut away in a single strip, so as to ensure its complete removal. It is enough to freshen the edge if the incision be made square, and in no case should it be bevelled. Every fragment of tissue in an operation for cleft palate is of importance, so that no more should be removed than is absolutely necessary.

In simple cases, when the edges of the flap come together readily in the middle line, the sutures may be inserted at once; but if there is the least tension upon them, it is better to pass underneath the palate a pair of blunt-pointed scissors curved upon the flat, and to cut transversely so as to divide the attachment of the palate to the posterior border of the palate bone. Professor W. Rose relieves the lateral tension by dividing the levator palati. "A narrow-bladed and probe-pointed bistoury is introduced through the lateral aperture in the palate upon either side, and is carried directly backwards through the soft palate." The tip of the uvula is first united by a horsehair suture introduced by a curved or rectangular needle fixed into a handle, and care must be taken to get exact approximation of the two points, so that the uvula should not afterwards look bifid. The suture is tied in a reef knot, and is left long. Its ends are then seized in a

pair of long dissecting forceps, and they are pulled backwards towards the pharynx until the uvula is stretched; a second horsehair suture is then introduced into the uvula and tied, and its ends are cut off. Three sutures are generally sufficient.

The main sutures in the muco-periosteum of the hard palate should be of silver wire (No. 30 or 32 gange). They are introduced from behind forwards, one at the base of the cleft, a second about the middle, and the third an-

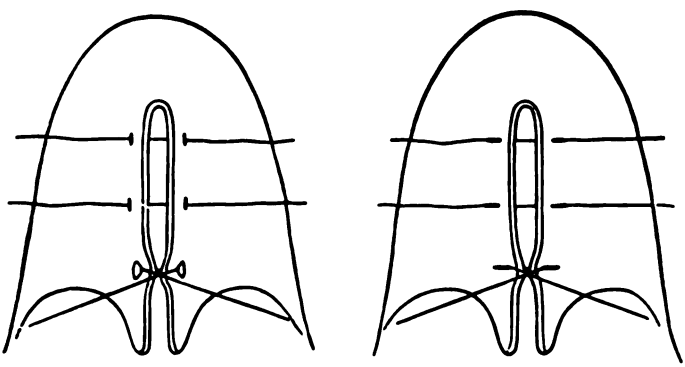

FIG. 29.—Diagrams showing the old method of inserting sutures in the operation of cleft palate (the left-hand figure), and the method recommended by Professor W. Rose (the right-hand figure).

[*Copied by permission from Prof. Rose's work on Cleft Palate and Harelip.*]

teriorly. Personally, I always use Mr. Thomas Smith's tubular needle, but many surgeons employ angular needles fixed in a handle. The wire sutures should not be drawn together until the secondary sutures have been introduced. The secondary sutures are of horsehair, and Professor W. Rose has shown that much better results are obtained when they are introduced by needles, whose cutting edge is at right angles, instead of lying parallel to the edge of the cleft like those generally made, as will be seen in the annexed

diagram (fig. 29). As soon as all the sutures are passed, the ends of the one in the uvula are cut short, the wire sutures are twisted up, the anterior one first, then the middle, and finally the posterior one. The horsehair sutures are then tied off, and in a nicely finished operation the united cleft should appear as a single line running straight fore and aft without any puckering. In tying the sutures, care should be taken that the edges of the wound do not become inverted.

When it is doubtful whether the hard or the soft palate should be closed, it is better to operate upon the hard palate first; but when it is possible, the whole palate should be closed by a single operation. The cleft is sometimes so large that it is impossible to close it by the ordinary linear incision, and Mr. Davies Colley has recently recommended an operation by means of flaps for these cases. The cleft again may be so large that no operative measures will close it, and such cases must be sent to the dentist to be provided with some form of obturator.

Dangers of the Operation.—No serious danger attends the actual operation for cleft palate, if the pharynx be kept clear of blood; but serious hæmorrhage from the descending palatine artery may occur as late as the ninth day, as in a case which I reported in the *British Medical Journal* for 1894. When this happens, the wound should be carefully explored in a good light, if ice and the ordinary measures fail to check the blood-flow, and an endeavour should be made to secure the bleeding point. Hæmorrhage, both immediate and remote, is due to puncture or partial injury of one of the main trunks of the descending palatine artery; and if it occurs at the time of the operation, the trunk must be completely divided, as the collateral circulation is so free that there is no risk of the flap sloughing.

After-Treatment. — The after-treatment consists in

keeping the patient very quiet, silent, and with his head low. Food should not be given for three hours after the operation, and only sparingly for twenty-four hours. Spoonfuls of warm milk and water may then be given at frequent intervals, with soups or jelly. Bread and milk may be given on the seventh day, but hard food should be withheld for at least a fortnight. The sutures may be removed in a fortnight or three weeks, the silver sutures being removed last. After each meal the mouth should be gargled with a 1 in 40 solution of warm boric acid solution.

Secondary Operations.—Some part of the cleft often remains unclosed, or, more rarely, the operation may be a total failure. When a small sinus alone exists, it should be left untouched for a time, as it occasionally closes spontaneously during the process of cicatrisation. If it fails to close, it may be touched with the point of a Paquelin's cautery. When the unclosed part is larger, a repetition of the original operation may be required.

EPITHELIOMA OF THE LIP.

Epithelioma of the lip occurs in children as a pathological curiosity, with the same characters, running the same course, and requiring the same treatment as in adults.

RANULA.

Ranula occurs either congenitally, as a cystic formation in connection with the glands of Nuhn, or due to blocking of one of the mucous follicles in the floor of the mouth. The tumour derives its name from a fancied resemblance to the guttural pouches in the frog. It is either placed laterally, or it may extend over the whole floor of the mouth.

Diagnosis.—The ranula must be distinguished from a dermoid cyst in the same region. The mucous membrane in a ranula is so thin that the fluid can be seen beneath it, and is glairy; whilst in a dermoid the covering is too thick to allow the more solid contents of the cyst to be visible. The diagnosis between a ranula and some forms of congenital cyst in the floor of the mouth can only be made by a microscopical examination of the wall, when the cyst, if it has been developed from the lower part of the thyreo-glossal duct, will be found to be lined with ciliated epithelium.

Treatment.—A radical operation should be performed as far as possible by extirpating the cyst, for puncture and injection of iodine do not give very satisfactory results. If the entire cyst cannot be removed, the mucous membrane is fixed with a pair of forceps, and incised. A large opening is then made into the cyst wall by the removal of a portion of the mucous membrane. The ranula thus treated cicatrises, and quickly heals.

THE TONGUE.

Injuries, ulcers, and new growths are as common in the tongues of children as they are in adults.

Injuries.

Children sometimes fall with the tongue between the teeth, and so inflict serious injury upon it.

Treatment.—It is necessary in such cases to put in one or two point-sutures of horsehair, and to keep the mouth washed out with an antiseptic solution. Repair readily takes place.

Glossitis.

The tongue may become inflamed spontaneously, and

either the whole of the organ or one side is involved. It does not suppurate, and the inflammation subsides under local treatment in the course of a few days. Some induration may be left.

Abscess of Tongue.

Abscesses of the tongue are not unusual; they are unilateral, and may be so chronic as to lead to their being mistaken for some form of new growth. They are sometimes tuberculous, but I think they are more often the result of injury.

Treatment.—The treatment consists in laying them open, scraping out their contents, and suturing the mucous membrane to obtain union by first intention.

Mucous Patches of Tongue.

Mucous patches are often seen in young children who have inherited syphilis. They are situated upon the dorsum of the tongue, and at the corners of the mouth.

Treatment.—They are quite amenable to treatment with grey powder, and local antiseptic applications of glycerine of borax.

Ulcers of Tongue.

Various forms of ulceration occur. The most common is the *aphthous* ulcer, either commencing as a patch in the ordinary way, or as a group of vesicles containing a clear fluid.

Dyspeptic ulcers are less frequent. They have a small central slough, with sharp-cut edges and a bright red zone round them.

Treatment.—Both forms may be cured by the application of the glycerine of borax, if proper attention be paid to diet. The more rebellious ulcers may be touched with a 1 in 10 solution of chromic acid.

Tuberculous ulceration is seen in the later stages of laryngeal phthisis, but it is sometimes primary. The ulcer is usually extensive, and is most often situated far back upon the dorsum, though it may involve the whole of the mucous membrane. The edges are sharply defined, and the ulcerated surface may have a characteristic warty and papillomatous appearance from the presence of small yellow points.

Treatment. — Palliative measures alone can be employed unless the ulceration is primary, when the tongue may be scraped with a sharp spoon.

Lupoid ulceration is very rare. It affects the anterior part of the tongue, and is generally the result of direct extension from the lips.

Treatment.—It must be treated by scraping away the diseased tissue.

Macroglossia.

Ætiology.—Macroglossia is a clinical term, embracing those pathological conditions which lead to enlargement of the tongue. The affection is usually congenital, and is most often produced by venous or lymphatic nævi, and in some cases by a combination of both forms. The enlargement is either unilateral, or it affects the whole tongue. It is often associated with epilepsy, idiocy, or other mental defects, and is occasionally found associated with endemic or sporadic cretinism, myxœdema, and acromegaly. Macroglossia is occasionally traced to an injury, or to chronic or acute irritation affecting the superficial parts of the tongue. The enlargement in these cases is probably associated with some interference with the lymphatic circulation (see also p. 497).

True hypertrophy of the several tissues of the tongue also occurs; but it is much less frequent than the older

writers thought, and is sometimes part of a unilateral enlargement of the head, or even of the whole side of the body. Tumours, either simple or, less frequently, malignant, may lead to a condition of macroglossia.

Symptoms.—The symptoms are unmistakable. The mouth is always open, the tongue protrudes, and usually curves downwards from the tightness of the frænum, leading to depression and eversion of the lower lip. The free salivation accompanying this condition usually leads to excoriation of the lips.

Treatment.—The treatment in those cases where the tongue protrudes to only a small extent consists in the application of judicious pressure; in other cases it may be necessary to remove a portion, or even the whole tongue. Electrolysis is not an effective method of treatment.

Papilloma and Soft Fibroma.

Papillomata and soft fibromata are not very unusual in children. They are situated far back upon the dorsum of the tongue, in the cases I have seen; but I do not doubt that they may occur at any part. They are readily removed with a pair of scissors. They occasionally grow again.

Lipoma.

Lipomata are so rare in the tongue as to be pathological curiosities. They grow in the substance of the organ.

Adenoma.

Adenomata or glandular tumours grow from the dorsum and back part of the tongue. They are occasionally cystic. It is thought that they may be accessory thyroid glands, for they are found to have a structure similar to that of the thyroid gland. Such tumours can sometimes be removed by a snare, but they usually have to be dissected out.

Malignant Tumours.

A few cases of sarcoma of the tongue are recorded as occurring in children, but they are excessively rare.

The only treatment is to excise that portion of the organ in which they are growing.

Dermoids and Congenital Cysts.

Dermoids and congenital cysts of the tongue and neck are considered under the heading of congenital defects (p. 512).

Anchyloglossa.

Anchyloglossa, or tongue-tie, is a bugbear of many mothers, though it is not of very frequent occurrence. The fear is clearly a relic of the time when, as Alexander Read tells us, about 1634, it was necessary to make "some just animadversions upon the temerity of midwives, who always wear one of their nails of a great length, and being thus ready with an incision instrument in their hand, wherever they come to do their office, they cut the new-born child's tongue; and unless they did this, they believe the children could never speak."

Ætiology.—It is a congenital defect caused by an undue breadth of the frænum linguæ, or else to the fact that the bridle extends too far forwards towards the alveolar border of the lower jaw.

Symptoms.—The tip of the tongue is drawn downwards, when an attempt is made to protrude it, and the deformity interferes with sucking.

Treatment.—It is easily remedied by slightly snipping the frænum with blunt-pointed scissors, care being taken not to operate upon "bleeders," and to keep the ends of the scissors well away from the ranine artery which runs along the base of the tongue. This is best done by putting

the frænum upon the stretch with the fingers, and snipping towards the floor of the mouth, and as close to the jaw as possible, as if to remove the frænum from the floor of the mouth and not from the tongue.

WOUNDS OF THE MOUTH.

Children, like adults, sometimes sustain penetrating wounds of the mouth and pharynx by falling whilst they are sucking a foreign body. A careful examination should always be made in such cases, for it may happen that a part of the foreign body gets impacted in the soft tissues, and is broken off so short that digital examination will alone reveal its presence. The body may remain for a long time undiscovered, and it may cause severe hæmorrhage by the ulceration it eventually sets up.

The following case is a good instance of such an accident. A boy, aged two years, fell on his face whilst he was pretending to smoke a clay pipe. His father picked him up, and seeing the pipe sticking out of his mouth, drew it away, but did not notice at the time that its end was broken. There was a wound on the right side of the mouth, at the junction of the upper alveolar arch with the palate, which bled profusely and was considerably swollen. The child was taken to a hospital, where the wound was probed, but no foreign body was discovered. He could hardly eat anything for a week, and for some time afterwards had to live upon soft food. There was profuse salivation, and for a month the wound discharged pus. The mouth in the situation of the wound remained red and swollen for two years, but there was no suppuration after the first month. Two years later, a portion of pipe stem was noticed projecting a quarter of an inch beyond the site of the old wound. It was loose, and was easily removed with a pair of forceps.

FOREIGN BODIES IN THE ŒSOPHAGUS.

Children who have swallowed various foreign bodies are constantly brought to the surgeon. In the majority of cases, the bodies pass smoothly through the œsophagus into the stomach, and are eventually cast out into the draught, though it sometimes happens that they are never seen again.

In every case, however, a child who is reported to have swallowed a foreign body should be examined with the finger, and even if nothing can be felt, a probang should be passed as soon as possible, partly for the satisfaction of the surgeon, but chiefly to relieve the anxiety of the friends. The usual treatment when the body has passed into the stomach, consists in giving porridge and hasty-pudding for a day or two, and then a purge of castor oil. The foreign body sometimes becomes impacted in the œsophagus, and if it is smooth, like a coin or a marble, it may give rise at first to very few symptoms, though sooner or later the mucous membrane swells, the muscular coat yields, and the impacted body becomes enclosed in a pouch, from which it is impossible to remove it without having resort to œsophagotomy. Suppuration often occurs in such cases, the temperature rises, and the child dies with pneumonia. The early recognition of a body impacted in the œsophagus is therefore of the greatest importance.

The diagnosis is often difficult when the body is smooth, but it becomes proportionately easier as the body is more irregular or ragged in outline. A halfpenny is just large enough to be firmly grasped by the œsophageal wall if it lies vertically. It is often situated flat along the posterior wall of the larynx, and it readily eludes recognition by lying just beyond the reach of the finger. The impaction

of foreign bodies in the lower part of the œsophagus is much less common, though I have seen a marble lying an inch above the cardiac orifice of the stomach cause death by ulceration in a girl of four years old.

Treatment.—A bimanual examination of the gullet must be made in all doubtful cases of impaction, and Dr. Polikier of Warsaw reports two cases in which he has been able to remove such bodies in children by external manipulation of the œsophagus. Emetics are never serviceable in causing a child to eject an impacted foreign body, for the straining which they produce is likely to lead to rupture of the softened tissues. Endeavours must at once be made, and with discretion, to dislodge the body by means of a probang or other instrument. Forceps have never proved themselves of any use in my hands.

Œsophagotomy must be employed when these measures are unsuccessful; and it should be performed at once, for the surgeon should remember that the operation is not a particularly dangerous one if it be done early, and before the temperature has begun to rise; while the child is almost certain to die if the body be left in position. The average mortality after opening the œsophagus to remove an impacted body is given by Fischer as 33 per cent.; but this, of course, includes many cases in which the operation was performed as a last resource. The operation is performed in exactly the same manner as in adults, upon the left side, and through an incision corresponding to that used for tying the upper part of the common carotid. Care must be taken not to injure the recurrent laryngeal nerve where it lies between the œsophagus and trachea, and not to wound the inferior thyroid artery until preparations have been made to secure it. The œsophagus should be made to project into the wound by passing a sound, catheter, or œsophageal forceps, through the mouth. It

ould be opened with a scalpel, and the opening must
larged by a pair of blunt-pointed scissors. The forei
dy must be gently removed with sequestrum force
d the wall of the œsophagus should be sewn up wi
mbert's sutures if it is healthy and not softened
olonged inflammation. The patient must be fed by t
ctum for a few days, but as soon as possible a s
theter should be passed into the stomach at meal-tim
me surgeons prefer to introduce the tube through t
se, and leave it in position for several days, only taki
out now and again to clean it. The tube causes le
ucial irritation when it is passed through the nose th
hen it is introduced through the mouth.

STRICTURE OF THE ŒSOPHAGUS.

Non-malignant strictures may occur at either end of t
ophagus in children: at the upper end, as a result
complete processes of development, at the point whe
e stomadæum joins the mesenteron, or more frequent
m cicatricial stenosis caused by swallowing corrosi
bstances, or by scalds. A very rare form of strictu
s been observed at the lower end of the œsophagus, d
simple hypertrophy of the muscular coat of the pylor

CHAPTER XIII

SURGICAL DISEASES OF THE TONSILS, PHARYNX, AND NOSE

CHRONIC ENLARGEMENT OF THE TONSILS.

NOTHING in the whole range of children's disease more often presents itself for treatment than chronic enlargement of the tonsils. The enlargement is most frequent between the ages of five and of twenty years of age, though it is not uncommon to see it in much younger children. It is by no means always associated with adenoid vegetations. The cause of the enlargement is unknown, but it is often associated with that debilitated condition which may pass with the assistance of a suitable infective agent into tubercle.

Varieties.—The enlargement assumes two distinct forms, the one truly hypertrophic, in which the organ is increased in size and studded with crypts. In these cases the lymphoid tissue is increased in quantity, and the vascular supply is correspondingly large, but there is only a slight increase in the connective tissue stroma of the gland. In the second form there is an overgrowth of the connective tissue elements, without a corresponding increase in the lymphoid tissue. In these cases the crypts are absent, the blood supply is diminished, and the tonsil often appears pale. The hypertrophied tonsils either increase in their lateral diameter, and project towards the

uvula, or they grow antero-posteriorly, when they lie flat in the fauces and may yet extend for some distance down the pharynx. Inflammatory adhesions sometimes bind down the tonsil to one or both pillars of the fauces. Both tonsils are usually enlarged, but it often happens that only one is affected.

Symptoms.—The symptoms are not easily mistaken in an advanced stage. The patient is slightly deaf, though the deafness is more frequent when adenoids are present; the character of his voice is so altered as to lead to the idea that he is talking with his mouth full, and there is an absence of nasal tone. The breath is foul, respiration and even deglutition may be impaired, and there may be many of the sequelæ associated with adenoids.

The deficient oxygen supply leads to anæmia, and predisposes the child to catch any infectious disease, at the same time rendering it less able to withstand the disease, so that it usually experiences the full force of an epidemic. A good instance of this recently came under my notice. Diphtheria attacked a family of four children; the two eldest, who were girls, had enlarged tonsils, and were repeatedly subject to tonsillitis. The third child, a boy, was healthy, and the fourth was a baby in arms. The two eldest children died, whilst the boy and the baby escaped. There is very great probability that if the enlarged tonsils in these cases had been removed before the attack, the two lives would have been spared. The deficient supply of oxygen is often a cause of nightmare in children; to be distinguished, as Dr. Bosworth very shrewdly remarks, by the fact that the nightmare of indigestion only occurs once in a night, whilst that due to want of air may be repeated many times.

The signs are equally obvious. The mouth is kept open,

as nasal respiration is often impossible. This leads, on the one hand, to drying of the fauces and a reflex cough; and, on the other, to the stupid expression which is so well reproduced in many of Du Maurier's pictures of society life. Impairment of hearing is also a very frequent concomitant of chronic hypertrophy of the tonsils.

FIG. 30.—Mathieu's Tonsil Guillotine.

Diagnosis.—Inspection of the fauces will at once confirm the diagnosis. This is best effected by pressing the tongue down firmly but slowly, and at the same time drawing it forward until a good view of the tonsils is obtained. This is done with a spatula, and the double movement necessary is easily acquired after a little practice. The only error into which it is possible to fall is to mistake an acute inflammation, or a new growth, for chronic enlargement of the tonsil.

Treatment. *Palliative.*—It is not necessary to perform tonsillotomy in every case of enlarged tonsils, but it is necessary to do so where they give rise to obvious signs of interference with the supply of air to the lungs, and when they are liable to recurrent attacks of inflammation. Only in very rare cases do they require removal a second time. Astringents should be employed where there is reason to suspect that the enlargement is due to chronic irritation, rather than to true hypertrophy. The astringents I have been accustomed to use are glycerin of tannic acid, a solu-

tion of nitrate of silver, four grains to the ounce, or a solution of sulphate of zinc, containing a drachm to the ounce. These solutions are painted over the tonsil night and morning by means of a camel-hair brush in a handle.

Operative.—The proper treatment for most cases of chronic tonsillar enlargement is removal. This was recognised by Celsus, who says (*Medicinæ lib. septimus*, xii. 2): "Tonsillas autem, quæ post inflammationes induruerunt, ἀντιάδες autem a Græcis appellantur, cum sub levi tunica sint, oportet digito circumradere et evellere: si ne sic quidem resolvuntur, hamulo excipere, et scalpello excidere; tum ulcus aceto eluere, et illinere vulnus medicamento, quo sanguis supprimitur." This method of removing the tonsils with a bistoury, after it has been seized and drawn forwards in a vulsellum, is still used by many practitioners, though it has lately been superseded by a tonsillotome. The particular form of tonsillotome employed is unimportant, for each surgeon uses the one with which he is most familiar. Heister's instrument, as modified by Matthieu (fig. 30), is very useful; but care should be taken to see that the bevelled and not the flat side of the cutting blade is next to the fork. Many surgeons, however, prefer a simpler instrument; but, whatever method is employed, as large a piece of the tonsil as possible should be removed.

It has long been an accredited piece of folk-lore that there is a relationship between the tonsils and the generative organs, and that if the tonsils be removed in children there will be a diminution or loss of the reproductive power after puberty. This hare has recently been started afresh in a half-joking way in America by Dr. Penrose (see the *Medical Gazette*, N.Y., 1881, viii. p. 92), and the fable has thus acquired a fresh lease of life, for I have several times been asked during the last few years whether there

was any truth in it. It is obviously false, and the converse is the more likely to prove true, owing to the impaired vitality produced by impeded respiration.

The mouth in unhealthy children should be washed out before the operation with 1 per cent. solution of carbolic acid, night and morning, for a few days; and if there is a purulent nasal catarrh, aristol may be insufflated into the nasal fossæ three times a day. Dr. Caillé has recently pointed out that it is well not to remove tonsils, if the operation can conveniently be postponed, during epidemics of diphtheria, for tonsillotomy in such cases is sometimes followed by an attack of diphtheria, due, no doubt, to the fact that bacilli which have been lying quiescent in the naso-pharynx thus gain access to an open wound.

The patient is placed upright upon a stool at the time of the operation, and the surgeon sits exactly facing him, and upon a slightly higher level, with a spatula in his left hand and the tonsillotome in his right; the nurse or assistant stands behind the patient, and steadies his head, whilst with her finger and thumb she presses on either side of the neck, just behind and below the angle of the jaw, to make the tonsil somewhat more projecting. No gag is required. The tonsillotome is easily introduced if the child's confidence has been gained; and it is much more satisfactory to do the operation in this way than to have recourse to force or to partial anæsthesia, though such means are sometimes unavoidable. The tonsillotome must be applied from below upwards, so as to include any portion of the gland which may be hanging down into the pharynx, and both tonsils should be removed at the same sitting. The pain is so trivial that I do not consider it necessary even to paint on cocain, since it is as troublesome to do so in a child as to remove the tonsils themselves. There may be rather sharp bleeding, and to prevent

the blood passing down the pharynx, the head is pressed forwards as soon as the tonsillotome with the excised piece of tonsil has been withdrawn from the mouth.

Tonsils may also be removed by the snare, by the galvano-cautery, and by the application of caustics, all methods which are less applicable to children than to adults. Broad, flat tonsils always require to be removed with scissors and forceps, for no form of guillotine will seize them. It sometimes happens that the tonsils are so soft that the guillotine cannot be used, for it merely tears through the tissue; or the glandular substance may be so adherent to the pillars of the fauces that it cannot be removed in the ordinary manner. M. Ruault has recently suggested that the tonsil in such cases should be removed piecemeal with a pair of punch forceps, liniment of iodine being afterwards applied to the bleeding surface. I have never had occasion to resort to such a method.

After-Treatment. — The after-treatment consists in giving the child bread and milk for forty-eight hours until the wound has healed, and, if necessary, applying a cold compress to the neck.

Dangers attending the Operation.—The operation in the large majority of cases is a trivial one, and if the pillars of the fauces are not injured the bleeding very soon ceases. It occasionally happens, however, that dangerous hæmorrhage[25] occurs either at the time of the operation, or some hours or days afterwards, and this possibility should always be borne in mind. The proper treatment for these cases is direct digital pressure upon the bleeding point, for it appears that styptics are usually without avail, and even ligature of the external and of the common carotid arteries has not arrested it. Mr. de Santi suggests that the method recommended by Mr. Treves for the arrest of bleeding in the neck might prove serviceable in these

cases. It consists in exposing the external carotid artery in the usual manner, and occluding it by tying a thick catgut ligature loosely round it. The circulation in the artery is arrested when the ligature is pulled upon, and is restored as soon as the traction is relaxed. The bleeding is generally arterial, and seems to come from a branch of the tonsillar artery; but it is sometimes a general oozing, which only ceases when the loss of blood has provided a natural styptic. If the bleeding be slight but troublesome, Sir Morell Mackenzie's formula may be used. It is, Acid. gallici ʒ ii.; acid. tannici ʒ vi.; aq. ℥ i. Misce. Sip and swallow half a teaspoonful at frequent intervals.

ADENOID VEGETATIONS[21]

(*Syn.* Post-Nasal Growths, Hypertrophy of the Pharyngeal Tonsil).

Adenoids are nodules of lymphoid tissue grouped into masses, and covered with ciliated epithelium. They are formed by a simple overgrowth of the lymphoid tissue normally found in the vault of the pharynx, and are frequently associated with chronic enlargement of the tonsils. These overgrowths are equally common in boys and in girls. They may be found at birth, and they sometimes persist into early adult life; but they are more frequently seen before than after ten years of age. Racial idiosyncracies are said to play a great part in their production.

They were first recognised by Czermak in 1860; but Wilhelm Meyer, of Copenhagen, was the first to attach importance to them as factors in the causation of disease.

Ætiology.—The growths occur in those who are predisposed to colds, perhaps in tuberculous subjects, and in those whose nasal passages are narrowed from any cause, either congenital or acquired. Such narrowing leads to

chronic hyperæmia, and in course of time to overgrowth of the tissues. Damp and cold climates are also predisposing causes, whilst a syphilitic taint produces a somewhat similar overgrowth of pharyngeal lymphoid tissue, which can only be successfully treated by the use of mercury.

The exciting causes of adenoid vegetations are those leading to chronic hyperæmia of the parts, such as repeated and neglected nasal catarrh, diphtheria, whooping cough, the exanthemata, especially measles and scarlet fever.

Symptoms.—The symptoms are snoring, a mucous discharge, altered speech, and, in time, a peculiar and characteristic aspect. The snoring is an early but not necessarily a constant symptom. It occurs, as Mr. C. A. Parker points out, because, during sleep, air enters the lungs through the nasal passages rather than through the mouth, as is usual when the patient is awake. He further shows that, although 86 per cent. of the cases of nasal obstruction sleep with their mouths open, in 82 per cent. the respiration is entirely nasal, and in 16 per cent. it is partly nasal and partly buccal. Bad dreams, night terrors, and sometimes slight delirium may be the result of this deficient aeration of the blood, whilst its remote effects are said to be anæmia, stunted growth, impaired cerebral development, deformities of the chest, asthma, laryngismus stridulus, and even epilepsy.

A muco-purulent discharge fills the nostrils and runs down the pharynx. The voice is characteristically altered, and the alteration is observed earlier in singing than in speaking. It is thick, and there is difficulty in pronouncing many of the consonants, thus B replaces P, D replaces T, and B is used for M; a change due in part to the enfeeblement of the soft palate, and in part to the nasal

obstruction, which no longer allows the vault of the pharynx to act as a sounding-board. The facial expression is characteristic in the later stages, for the patient has a dull and heavy look, with a sallow complexion. His lips are prominent, thick, and without expression, and his mouth is open. The nostrils are narrow, and each ala of the nose is indented at the junction of the superior and inferior lateral cartilages, whilst the bridge is broad, and is often crossed by a congested vein. The broad bridge and the narrow alæ make the eyes appear unduly far apart. The patient is often hard of hearing, and, in advanced cases, the arch of the palate loses its rounded form and becomes more pointed.

Chronic hypertrophy of the tonsils is usually associated with adenoid vegetations; but it often happens that the growths occur independently of chronic tonsillitis. The pillars of the fauces, the soft palate, and the uvula are congested. The parts look dusky and flabby, and there is often impaired movement of the palate. The back of the pharynx is covered with muco-pus, and it is studded with large and pale granulations, increasing in size as they approach the naso-pharynx. The results of the obstruction act in two directions. In the early stages, as Dr. Scanes Spicer has shown, the presence of the adenoids leads to chronic congestion and hypertrophy of the post-nasal mucous membrane, with dilatation of the vein running across the roof of the nose; whilst in the later stages, the obstruction may be so complete as to lead to pharyngitis sicca, for the air only passes through the inferior meatus of the nose, and so is insufficiently moistened.

Diagnosis.—The diagnosis is readily made in all stages of the disease by digital examination of the naso-pharynx. The surgeon should stand behind and on the right side of the patient, who sits in a chair. He wraps a piece of lint

round his left forefinger, or protects it with a shield of horn or celluloid, and employs it as a gag, whilst he introduces his right index into the mouth, passing it beyond the soft palate, and then bending it upwards to explore the naso-pharynx. The exploration must be done methodically, and the growths are detected as masses of soft and velvety tissue, in the form of ridges, cushions or lobules at the upper part and sides of the posterior nares. A firm pad of thickened tissue, situated in the pharyngeal vault, a little to one side of the middle line, can often be felt when the growths have disappeared spontaneously. Posterior rhinoscopy, in experienced hands, gives good results, and it may readily be applied to tractable children. It is often a useful supplement to digital examination, unless the tonsils are enlarged, when it is a very difficult method to use. Bosworth's mode of detecting nasal obstruction may be used in doubtful cases. It consists in spraying sweet oil into one nostril. The heavy spray returns with almost equal force through the other nostril, if the nasal passages and naso-pharynx are quite clear, but not otherwise.

Differential Diagnosis. — Adenoids are to be distinguished from polypus of the nose, which is very rare in children; from fibrous growths, which are harder than adenoid vegetations; and from enlargement of the posterior ends of the inferior turbinated bones, which are easily recognised by digital examination. Retro-pharyngeal abscess is so painful, and runs such a rapid course, that it is not likely to be mistaken for post-nasal growths; whilst a retro-pharyngeal sarcoma causes more bulging of the surrounding parts, especially of the soft palate, and leads to greater enlargement of the cervical glands.

Sequelæ.—Adenoids are a frequent cause of deafness, and of inflammation of the middle ear. They produce

hyperæmia of the Eustachian tubes, and of the tympanic cavities, which leads to thickening of the mucous membrane lining the cavities of the ear, or to an increased activity of the glands, terminating in a suppurative inflammation, with subsequent perforation of the tympanic membrane. The frequency of ear-trouble in these cases is explained in many ways, but every one agrees that it is associated with diminished air tension in the middle ear.

Treatment. — The increased liability to disease to which children with adenoids are liable, renders it advis-

FIG. 31.—Two forms of Gottstein's Curette, used in removing adenoids.

able to remove the growths as soon as they cause the patient to breathe through his mouth. They do not recur after complete removal; but it is not sufficient to scarify them, or merely to crush them. The child should be put under chloroform, so that the operation may be performed with deliberation, and it is of extreme importance that the anæsthesia should not be too deep. The patient should be able to cough reflexly throughout the operation, as there is then less risk of suffocation from blood entering the larynx. Every operator has his favourite position and method of removal. I am accustomed to have the head hanging over the end of the table, so that the blood does not run down the throat, although in this position there

is increased venous engorgement of the head and neck; but many surgeons prefer to have the patient lying upon his side, with his head level with the rest of his body. A gag being placed in the mouth, the growths are systematically removed, through the mouth and naso-pharynx, with some modification of Loewenberg's forceps, with Meyer's ring knife, Gottstein's curette (fig. 31), with Sir William Dalby's artificial finger-nail (fig. 32), or, less preferably, with the finger-nail itself; and it is often necessary to use a combination of these instruments before the growths can be completely extirpated. Many operators, however, choose to remove the growths with a sharp spoon

FIG. 32.—Dalby's Artificial Nail, employed in removing adenoids.

passed through the nares, and guided by a finger in the mouth. The nasal cavity is repeatedly swabbed out during the operation with wet absorbent wool. The bleeding is very free; but it usually stops as soon as the gag is removed and the mouth is closed. The tonsils should be removed if it is necessary, and whilst the patient is still unconscious.

The operation is not quite free from risk, as it sometimes causes a sharp attack of suppurative inflammation in the middle ear two or three days afterwards. This may be due to the entrance of blood through the Eustachian tubes, and it is especially likely to occur in those cases of sub-acute otitis media which are characterised by thickening and retraction of the tympanic membrane, or by its perforation. Pneumonia occasionally results from

the passage of blood into the lungs; but this should not occur if proper care be taken at the time of the operation.

After-Treatment.—Little or no after-treatment is required, except to keep the patient in bed for a day or two in a warm room, and to give soft food until the bruised parts have recovered. A gargle or an alkaline spray, similar to that used for diphtheria (chap. xvii.), may also be employed for a week, and the Eustachian tubes should be inflated regularly, if the deafness remain more than a fortnight or three weeks after the adenoids have been removed.

The beneficial effects of the operation are often very striking. The patients rapidly increase in height, weight, and chest girth, and at the same time lose the facial expression which had previously characterised them.

ACUTE TUBERCULOUS INFLAMMATION OF THE PHARYNX.

The pharynx in children is occasionally the seat of an acute tuberculous ulceration. It may be the result of an extension from the soft palate and uvula, but is usually secondary to disease of the lower part of the respiratory tract. Drs. Abercrombie and Gay,[28] who have paid special attention to the condition in England, say that the first sign is the appearance of small discrete papules on the soft palate, pillars of the fauces, and still more rarely, on the posterior wall of the pharynx. These papules are tuberculous; they caseate and then ulcerate, implicating the surrounding parts, and causing great destruction of the tissues. The mucous membrane is swollen, and is covered with a viscid, whitish secretion, which may be mistaken for a diphtheritic membrane; but it is less organised and more friable. The retro-pharyngeal and cervical lymphatic glands become enlarged, and the latter may suppurate, or the glands may

subside entirely before the termination of the case. The chronic form of this condition is lupus (p. 57).

Symptoms.—The first symptom is pain, with more or less dyspnœa; a nasal quality of the voice, from impaired action of the palatal muscles; and pain in the ear from implication of the Eustachian tube. Deafness occasionally occurs.

Diagnosis.—The ulceration is not always easy to see, on account of the viscid secretion which covers the fauces. Follicular tonsillitis, diphtheria, and the mucous patches of inherited syphilis have to be distinguished from this condition of acute tuberculous ulceration of the fauces.

Prognosis.—The prognosis is extremely bad; nearly all the cases have terminated fatally, for the condition appears to be a part of a general tuberculosis. The immediate cause of death is dysphagia.

Treatment.—The treatment is unsatisfactory, for little can be done except to relieve the pain by insufflations of morphia, or by cocain spray.

NASO-PHARYNGEAL TUMOURS.

Pathology.—Tumours of the naso-pharynx are not uncommon in children. They are either simple fibromata, the fibrous tissue sometimes having a nævoid character, so that the tumour is a fibro-angioma; or they are fibro-sarcomata; or, more rarely, they are atypical, and contain cartilage cells. The tumours, in either case, are generally single, and have a large base of attachment. They usually grow from the fibrous tissue covering the basilar process of the occipital bone; but many cases are known to have originated in the pterygo-maxillary fossa. They grow irregularly, and often acquire secondary attachments. Nothing is known of their cause. They are found almost exclusively in boys and in young adults. They are rare

in children under ten, and are most common between the ages of eleven and twenty-five.

Symptoms.—The earlier symptoms marking their growth are so slight that the patient is not brought for advice until the growth has attained to a considerable size. The slight epistaxis, the constant nasal secretion, the chronic headache, and the hardness of hearing which mark the early stages of growth, are usually attributed to chronic cold in the head, or to adenoids. It is not until the symptoms increase that the patient is brought for advice, and then, a digital examination of the back of the pharynx readily enables the tumour to be felt. This examination must be conducted with the greatest gentleness, for it sometimes leads to a sharp hæmorrhage.

Prognosis.—The younger the patient the more quickly the tumour grows, and if it be left alone the most disastrous results follow. The nasal fossæ become dilated, and the growth invades the surrounding parts, growing upwards into the orbit and brain, laterally into the zygomatic and temporal fossæ, downwards into the mouth, and forwards into the cheek, producing the most frightful deformity. Death may take place within a few months of the first symptoms, or it may be postponed for a year or two.

Diagnosis.—A naso-pharyngeal fibroma or sarcoma is not likely to be mistaken for anything else. It is recorded, however, that a retro-pharyngeal abscess was mistaken for such a growth in one case; whilst in others, an encephalocele projecting into the pharynx led to a similar error in diagnosis.

Treatment.—The treatment of the smallest innocent tumours consists in twisting them off with forceps, introduced either through the mouth or nostril. The larger polypi and the sarcomatous forms require much more

severe measures. Pedunculated fibromata may be removed by the galvano-cautery, if the loop can be passed over the pedicle. If this is impossible, Mr. Walsham recommends that the soft palate should be split, and its edges drawn aside by threads passed through them; and if this proceeding fails to give sufficient room, a portion of the hard palate must be gouged away, until the polypus can be reached with a snare. The edges of the palate are then sutured with horsehair, as in the ordinary operation for the repair of a cleft. In either case the base of the polypus must be destroyed by the actual cautery. Rouge's method of reflecting the upper lip and detaching the alæ nasi, until the whole of the anterior nares is exposed, is sometimes serviceable for the removal of polypi which are attached more anteriorly. Sarcomata can only be extirpated by a formal removal of the superior maxilla, either by the major operation of excising the whole bone, or less commonly by the minor operation, which consists in leaving the orbital plate. The operation must be performed at the earliest possible opportunity, and for this reason the earliest recognition of the growth is of great importance. This can be effected in the case of sarcomata springing from the antrum by introducing a small electric light into the mouth in a dark room, when the affected antrum will appear less translucent than its fellow; but this loss of translucency is only diagnostic of an antral tumour, and it may be due to an abscess. Electrolysis is sometimes useful in the treatment of the more slowly growing tumours.

RHINOLITH.

Children so often push foreign substances into the various orifices of their bodies, that it is not surprising if they sometimes remain where they have been put, and are forgotten. This is especially the case with foreign bodies

pushed into the nose. They may lie there for years, and become encrusted with carbonate and phosphate of lime, intermixed with much organic matter, until, by their irritation, they cause a discharge, and a complete blocking of one nostril. All cases in which there is a persistent and fœtid discharge from one nostril should be examined with a view to detecting the presence of a foreign body, and it is best to make the examination under an anæsthetic. The rhinolith is readily detected, and the only thing for which it is then likely to be mistaken is a piece of dead bone, leading to ozæna.

Treatment.—The rhinolith is easily dislodged and removed by means of a pair of dressing forceps. The nostril should be washed out for a few days with a warm solution of boric acid.

CHAPTER XIV

DEFORMITIES AND DISEASES OF THE EAR

SUPERNUMERARY AURICLES.

SUPERNUMERARY auricles or pre-auricular appendages are by no means uncommon. Their size and their situation vary greatly. They are sometimes mere tags of skin, with, or more often without, any perceptible elastic or fibro-cartilage. They are attached immediately in front of the pinna of the ear, or at some point in the line extending from it to the angle of the mouth, or more rarely at some distance from it, on the cheek of the same side. They bear a closer resemblance to the auricle in other cases, and are situated along the anterior border of the sterno-mastoid muscle, either opposite the thyro-hyoid space, or immediately above the sterno-clavicular articulation. They may be associated with the remains of branchial clefts, in which case they may lie above a minute fistulous opening in the skin. They are either single or multiple, unilateral or bilateral, and the pinna of the ear upon the side on which they grow is often badly developed. Dr. Ballantyne,[27] who has recently studied these growths with great care, says that they are so often associated with other defects, that probably nearly every case on careful search will reveal at any rate *minor* malformations of the ear, eye, or mouth, and very often major alterations in other parts of the body.

Pathology.—Mr. Bland Sutton ingeniously points out

that the pinna may be regarded as an enormously developed operculum, modified for acoustic purposes, and that some supernumerary auricles may be looked upon as persistent opercula, or coverings to the primitive gill-slits.

Treatment.—No harm comes from their immediate and complete removal, even in the youngest children; but the surgeon must be prepared to ligature the small central vessel.

HYPERTROPHY OF THE PINNA.

Hypertrophy of the pinna sometimes causes great deformity, for the ears may stand out or flap forwards.

Treatment.—When there is only slight deformity, an attempt may be made to keep the ears in position by means of a pair of pads, connected together by a steel spring passing over the top of the head. A formal operation is required in the more severe cases. Prof. Keen recommends that a good-sized and oval flap of skin should be removed from the back of the auricle, and that a V-shaped groove should be made along the whole length of the cartilage. The edges of the wound are then brought together, and as soon as it has healed, the auricle may be attached to the head by a single point-suture so as to keep the ear in place, until cicatrization is sufficiently advanced to render such mechanical means unnecessary. A triangular piece of the auricle may require removal in still more severe cases, the apex of the triangle being directed towards the meatus.

ECZEMA AURIS.

Eczema of the external ear is a very chronic affection, which often leads to total occlusion of the external auditory meatus, at first by granulations, and afterwards by dense cicatricial tissue. It is often associated with a long-

continued discharge through the meatus, due to purulent inflammation of the middle ear.

Treatment.—The treatment consists in removing the granulations with a sharp spoon, and keeping the ear plugged until healing takes place under the influence of cod-liver oil and grey powder, with rhubarb. A little powdered oxide of zinc may be dusted over the eczematous patches two or three times a day, or the ear may be plugged with gauze soaked in camphorated naphthol.

FOREIGN BODIES IN THE EAR.

Foreign bodies in the ear consist of the various substances introduced by children into the external auditory meatus. Impacted wax in the ears is less common in children than in adults, for in children the cerumen generally becomes fluid, instead of forming inspissated masses. Children are somewhat more liable to blocking of the external auditory meatus by plugs of epithelial cells, which are densely hard, and require numerous and prolonged applications of a 1 in 10 solution of bicarbonate of soda before they can be softened.

Treatment.—The surgeon must first ascertain whether a foreign body is really present in the ear, by actual inspection with an otoscope by means of reflected light, and he must then determine its nature.

If *wax* alone be present, it should be washed away by a gentle stream of warm boric acid lotion; but if it is hard, it must be softened in the ordinary manner, by dropping a little warm oil into the meatus, night and morning, and then gently syringing it out of the canal as soon as it has become softened.

A foreign body may be difficult to discover, as it often lies on the anterior inferior wall of the meatus, where it is

quite concealed. The meatus in such cases must be carefully explored with a bent probe.

Insects are first killed by filling the ear with olive oil, which suffocates them by filling their tracheæ, and they are afterwards syringed out of the ear with warm water. Foreign bodies like *beads*, which will not swell when they are moistened, may be removed by syringing. In each case, the child is so placed that the affected ear is most dependent, whilst the stream of water is directed along the upper wall of the meatus, the auricle being pulled backwards and upwards to convert the channel into a straight line.

This method cannot be used for *peas, beans, or paper wads.* They must either be left alone, or an attempt may be made to extract them by anæsthetising the child, and introducing a loop of stout silver wire with the greatest gentleness. When this fails, the agglutinative method may be employed; but I have never had recourse to it. The child is put to bed, and a camel-hair brush soaked in a little glue is put into the ear, so that the bristles rest upon the foreign body. The brush is withdrawn as soon as the glue has set. It is sometimes necessary to make an incision behind the ear in order to gain access to the external auditory meatus, when the foreign body may be extracted with a pair of toothed forceps; but sometimes the wisest plan is to let them alone.

CHRONIC PURULENT INFLAMMATION OF THE MIDDLE EAR.

Ætiology.—Otorrhœa is one of the most frequent and troublesome conditions met with in children. It occurs from many causes, and if it is not due to the impaction of foreign bodies, or to growths in the external auditory meatus, it is most frequently caused by otitis media.

Rasch, of Copenhagen, found evidence of middle ear disease in no less than 70 cases out of 82 autopsies made upon the bodies of children under two years of age, whilst Kassel found it in 85 cases out of 108 children under one year, who had died of various diseases.

The affection may begin as a chronic suppurative inflammation, apparently without cause; but its origin is much more frequently referred to an attack commencing during measles, scarlet fever, or diphtheria, or to some chronic or infective inflammation of the naso-pharynx. It appears to be especially frequent after broncho-pneumonia, when it leads to deafness without perforation, and is then very likely to be overlooked.

Dr. Walker Downie,[29] in a recent and interesting paper upon inflammation of the middle ear, in connection with the exanthemata, is inclined to think that the increased tendency to suppuration in these cases can be explained mechanically. He says that when a child is suffering from measles or scarlet fever he is confined to bed day and night, so that during the greater part of the twenty-four hours he lies on his back. This position favours the retention of secretions within the hollow of the naso-pharynx, whilst from the altered direction of the Eustachian tubes, the inflammatory products in the middle ear are unable to escape, even supposing the tube to remain patent. The consequences are that the catarrhal inflammation accompanying measles and scarlet fever is soon followed by suppuration, the lining membrane of the tympanum becomes necrosed, the tympanic membrane is ruptured, and the bony cells surrounding and communicating with the tympanum are filled with the products of suppuration. Damp and insanitary surroundings also appear to exercise a great influence in the causation of otitis media, by the depressing effects which they exercise

upon the general health, leading to an increased predisposition to infective diseases.

Pathology.—Dr. Blaxall's investigations show that the most potent factor in the production of otitis media, following scarlet fever, is the streptococcus pyogenes, and that the next most important organisms are the staphylococci, albus et aureus. The diplococcus pneumoniæ of Talamon and Fraenkel, and the bacillus pneumoniæ of Friedländer, may however accompany the inflammation in those forms which are not due to scarlet fever.

Morbid Anatomy.—Politzer describes very carefully the changes which take place in the various parts of the ear, as a result of chronic suppurative inflammation. The mucous membrane of the Eustachian tube is swollen, the epithelial cells proliferate, and the mucous glands enlarge; but it is unusual to meet with polypoid granulations.

The mucous membrane in the middle ear is at first much thickened by the formation of inflammatory tissue, whilst the mucous glands and the blood-vessels are greatly increased in size. There is a formation of new connective tissue in the later stages, associated with polypoid masses of granulation tissue which spring from the ulcerated parts of the mucous membrane.

The membrana tympani is most frequently ulcerated at that part which is situated midway between the periphery and the handle of the malleus. The perforation is not always easy to see, for the membrane may be swollen and thickened. Prof. Politzer therefore recommends that in cases where the existence of a perforation is doubtful, the external auditory meatus should be filled with warm water, and air should be forced through the Eustachian tube by means of his bag. Air will then bubble through the water if the membrana tympani be perforated. When the suppuration has ceased, the perforation either

remains as a permanent orifice, or it becomes closed by a delicate film of scar tissue.

The inflammation extending to the external ear often leads to a condition of eczema (p. 291), to cicatricial contraction and narrowing of the orifice, to polypi, or to a dense mass of granulations which may eventually cause obliteration of the external auditory meatus.

Symptoms.—The symptoms are seldom well defined. There is often pain, which is worse at one time than at another, owing to intercurrent attacks of acute inflammation. There is also local tenderness beneath the pinna of the ear. The headache is usually either lateral or occipital; and if caries of the temporal bone has taken place, there may be giddiness, vomiting, unsteady gait, and increased tinnitus. The impairment of hearing is generally very marked, and there may be alterations in taste and smell, though as no complaint is made spontaneously by the patient, they are only to be ascertained by testing these senses.

The discharge may be bilateral; it occurs after the membrana tympani is ruptured, and it lasts for an indefinite period. It varies greatly in quantity and in colour, and it always contains micro-organisms. Perforation of the membrana tympani usually takes place early. The aperture is generally single, and is round, oval, or elliptical in shape.

The inflammation runs a very protracted course, and the suppuration usually continues uninterruptedly, though it sometimes ceases spontaneously to return after weeks, months, or years, with or without acute symptoms. These relapses are often due to cold, to naso-pharyngeal catarrh, to the exanthemata, or to the entrance of water into the middle ear through an unclosed perforation. It is well, therefore, to warn boys who have been temporarily cured of otorrhœa due to middle ear disease to avoid plunge baths, unless they put a piece of cotton wool into their ears, and

to recommend them not to practise diving from a height under any circumstances. The discharge ceases in many children during the summer, and returns again in autumn.

The chronic nature of the disease appears to be due to the retention of the purulent exudation in the various recesses of the middle ear, though it is partly accounted for by the periostitis and caries of the temporal bone, with which it is often associated, and partly by the continuance of the original source of infection in the naso-pharynx.

Prognosis.—The prognosis is always uncertain so long as the discharge continues. It is unfavourable when the otorrhœa is profuse and is persistently septic. It is favourable when the discharge has ceased, so long as the hearing improves. The prognosis for the recovery of the hearing is favourable if the hearing distance remains stationary, but unfavourable if there are continual subjective noises, or if there is a diminution in the sense of hearing conducted sounds, as tested by a tuning-fork placed upon the head.

Diagnosis.—Otitis media sometimes simulates meningitis very closely, especially in children who are too young to indicate the seat of their pain. There is sometimes marked retraction of the head. The symptoms in otitis, however, are often markedly relieved by puncturing the membrana tympani and by inflating the Eustachian tubes, whilst such treatment is ineffectual in meningitis.

Treatment.—The treatment consists in keeping the middle and the external ear scrupulously clean, and it is the great difficulty in doing this which makes the cases so intractable.

Dr. Walker Downie says [29] that in the exanthemata from the very beginning of the illness, where there are any catarrhal symptoms, the patient should be directed to use his pocket-handkerchief frequently and strongly, and the attendant nurse should be instructed to see that he does

so. By this means the nasal discharge is got rid of through the anterior nares, and the air, in passing with considerable force from the lungs towards the nose, helps to loosen and to dislodge any discharge lying in the naso-pharynx. Politzer's inflation bag should be used when the child is too young to blow its nose efficiently, or when the tonsils are enlarged, or the patient has adenoids. The quantity of secretion dislodged and thrown into the mouth by such inflation is very remarkable. One or other of these methods should be employed, in every case, without waiting for the appearance of symptoms pointing to implication of the ear. When, on the other hand, there is dulness of hearing, and when there are sounds or pains in the ears, resort to inflation should never be delayed, as these symptoms point to closure of the Eustachian tubes, and to retention of secretion within the middle ear, and relief may be instantaneously secured in the majority of cases by complete inflation.

Inflation.—There are many methods of inflating the middle ear, for there are many ways of opening the Eustachian tubes at the instant when the blast of air is forced out of Politzer's bag. The child may be placed in a recumbent or sitting position, and the tube from the bag is placed in one nostril whilst the opposite one is closed, and he is directed to say "hic, hæc, hoc," when the bag is compressed. This method, serviceable enough for young adults, is useless in children, and for them the bag must be gently squeezed whilst the child blows through a narrow tube with sufficient force to distend the cheeks. Dr. Dundas Grant suggests that a pipe-stem or a Eustachian catheter answers the purpose very effectually. Air or steam, impregnated with a minimum of chloroform vapour, passes more easily into the Eustachian tubes than it would otherwise do.

Myringotomy.—When there is very great pain, and

the symptoms point to acute tension within the ear, great relief is often obtained by counter-irritation, by local blood-letting, and by puncturing the tympanic membrane. The operation is a simple one. The child is placed in a good light, and his head is held steadily by an assistant. The surgeon reflects light into the external auditory meatus from a laryngoscope mirror, until he obtains a good view of the swollen drum. He then makes a slit into the lower and posterior portion where the bulging is most prominent. Proper myringotomes are sold for the purpose, but a straight and sharp-pointed eye-needle, such as is used for paracentesis corneæ, does perfectly well.

When the discharge has become chronic and is very profuse, the ear must be syringed out three or four times a day with boiled water at a temperature of 80° F., twice a day being sufficient after the first day or two. If the discharge be excessive, four or five drops of oil of turpentine may be added to each eight ounces of water. A 1 in 1000 solution of perchloride of mercury may be substituted when the discharge is very offensive. A 2 per cent. solution of peroxide of hydrogen, or a 5 per cent. watery solution of resorcin, has also given me good results. All the solutions should be used warm, as they are less apt to produce giddiness than when they are injected cold. Very tenacious secretions may be removed with cotton-wool twisted round a probe.

Dr. Rattel claims that the following method is useful in cases of very chronic suppuration when there are granulations. Its great objection seems to be that the amount of the douche is so large. His formula is:—

℞ Chloral hydrate, 1 drachm.
Biborate of soda, 1½ drachms.
Water, 1 pint.

Dissolve and make a lotion.

A pint of this solution is to be gently injected into the ear night and morning. The hydrate of chloral, he says, is partially decomposed by the alkaline borax into chloroform and formiate of soda, so that the solution is both sedative and antiseptic. The granulating surfaces are also to be touched three or four times a week with a 1 in 30 solution of zinc chloride applied to the middle ear by means of a Toynbee's speculum. The ear must be carefully dried after every application, and a piece of cotton-wool should be introduced into the ear.

Local remedies must be discontinued as soon as the suppuration has ceased, for they have a tendency to bring it on again. A little boric acid may be insufflated once or twice a week when there appears to be any likelihood of a relapse, and the occasional instillation of a few drops of warm alcohol is often productive of the greatest benefit.

Scarlatinal Otitis.

The worst form of chronic suppuration occurs in scarlet fever, especially if it be associated with acute membranous inflammation of the naso-pharynx. The inflammation begins at the height of the disease, and is marked by very severe pain with rise of temperature and an increase in all the cerebral symptoms. Perforation of the tympanic membrane takes place early. The course of the disease is usually very protracted, but it may be shortened by incising the tympanic membrane, within the first twenty-four hours after the onset of the symptoms, in the manner described at page 298.

Severe deafness often remains, owing to the inflammation spreading to the internal ear; and if this occurs in young children, they may never learn to speak, and so remain deaf and dumb.

Treatment.—The treatment, after incision of the tympanic membrane, consists in filling the ear with lime-water, which should be allowed to remain in the external auditory meatus for ten minutes, in order to loosen the membrane. The ear should then be gently syringed with sterilised water, carefully dried, and afterwards filled with powdered boric acid. This proceeding must be repeated three or four times a day.

Typhoidal Otitis.

Inflammation also occurs secondarily to typhoid fever; the symptoms usually begin during the fourth or fifth week of the disease, though they may appear much earlier. Severe deafness may continue for a long time, but fairly good hearing is usually regained.

Otitis after Influenza.

Inflammation of the middle ear sometimes occurs after influenza. A child of a year old was brought to me in February, 1894, suffering from a mastoid abscess, which his mother attributed to the influenza from which he had suffered six weeks previously. The pain is very severe, and is not relieved by the rupture or perforation of the membrana tympani. There is protracted suppuration, and a great tendency to the formation of a mastoid abscess with rapidly extending caries, which renders early operative interference very necessary. A fatal termination from meningitis, cerebral abscess, and thrombosis of the sinuses, is not uncommon.

Otitis in Tubercle and Syphilis.

Suppuration of the middle ear may follow tubercle or syphilis, but in either case there are other manifestations of the constitutional condition. There is but little pain in

rculous otitis, and perforation does not usually take
, so that the condition may be overlooked until the
rence of facial paralysis renders a more careful ex-
ation imperative. The superficial and deep lymphatic
ls near the mastoid are then found to be affected.
e is often very great destruction of the petrous portion
e bone; and when the case has terminated fatally, the
psy may show that the base of the skull has been
iversely involved, so that an inflammation of the op-
e ear may be the result of a direct extension of the
rculous process.

CHAPTER XV

DISEASE OF THE TEMPORAL BONE AND THE CEREBRAL INFLAMMATIONS ARISING FROM IT

INFECTIVE inflammation of the temporal bone usually affects its mastoid and temporal portions. It either begins as a periostitis, associated with osteomyelitis, rapidly running on to the formation of an abscess behind the ear, or it is the result of the extension of inflammation from the middle ear, leading to disease of the bone, and perhaps spreading to the brain or its membranes.

ACUTE MASTOID OSTEOMYELITIS.

Symptoms.—The more superficial form of disease leading to mastoid abscess is characterised by severe pain, increased when the patient lies down. There is much constitutional disturbance, owing to the unyielding nature of the tissues overlying the mastoid process, and this may be accompanied by vertigo, with vomiting of a cerebral type —that is to say, without nausea. There is great irritability of the nervous system, acceleration of pulse, rise of temperature, rigors, tinnitus, dizziness, sleeplessness, and occasional excitement. The skin over the mastoid process is infiltrated and swollen. It pits upon pressure, and beneath it is a hard swelling, in which it is sometimes easy and sometimes impossible to detect fluctuation. The swelling is itself very tender, and it tilts the pinna of the

ear forward in a manner which can hardly be mistaken for anything else. The swelling may extend above the mastoid process into the temporal region, and it may lead to bulging of the posterior wall of the external auditory meatus to such an extent as to close its lumen.

Treatment.—The swelling should be incised at once, and if possible before suppuration has taken place. When an abscess has formed, its contents should be gently scraped away, and it should be packed with lint soaked in camphorated naphthol (p. 8). It may open spontaneously after some weeks, if it is left untreated, leaving a sinus; or it may make its way backwards, to form a retropharyngeal abscess, or forwards into the glenoid cavity, eventually causing unilateral anchylosis of the lower jaw. The fistulæ are sometimes very long in healing, but they rarely lead to more extensive trouble. They should be scraped and dressed antiseptically.

CHRONIC MASTOID DISEASE.[30]

Chronic infective disease of the middle ear is the most fertile source of extensive disease of the temporal bone, though tuberculous disease occasionally causes it. It is of very frequent occurrence in children; for during the last four years more than thirty cases of disease of the temporal bone, connected with ear trouble, have been admitted to, and operated upon in the wards of the Victoria Hospital for Children.

Morbid Anatomy.—The inflammation of the middle ear extends either upwards or backwards, and in children it usually passes along the suture of the petrous with the squamous portion of the temporal bone, or it may spread through the bone itself. The dura mater may thus become involved in the inflammatory process, which actually

destroys the bone and leads to thrombosis of the lateral sinus.

CEREBRAL ABSCESS.

Cases of long-standing inflammation of the middle ear and of the mastoid process sometimes terminate in an abscess, formed in the white matter of the brain; either in the temporo-sphenoidal lobe, or about half as often in the cerebellum, though in rarer cases the abscess is formed between the dura mater and the pia mater. These abscesses are always single. They vary greatly in size, some only containing a few drops of pus, whilst others may contain several ounces, and they may open into the lateral ventricle. Some observers think that they are a little more common on the right than upon the left side, owing to the greater size of the right lateral sinus, which is thus more likely to be involved in the inflammatory process. The abscesses usually cause death, unless they are opened by surgical means; but they occasionally discharge their contents through the external ear, or even through the side of the skull. Sometimes they become encysted, and, under exceptional conditions, they may be absorbed. The pus varies in colour, it is usually bloodstained; but it may be greenish-yellow, and it is sometimes fœtid and thin.

Causes.—Cerebral abscess may also follow a compound fracture of the skull, when it is more frequent in the upper and anterior parts of the brain; or it may arise from general infective conditions, as in pyæmia, occurring in connection with fœtid bronchitis, empyema, infective peritonitis, or osteomyelitis of the long bones.

Symptoms.—The symptoms of cerebral abscess in connection with middle ear disease are tolerably well defined, though cases occasionally occur in which the most ex-

perienced surgeons are mistaken. The typical history is, that a child, who has long been suffering from a stinking otorrhœa, catches cold, or receives a blow on the side of the head. He complains, either in a few hours or after some days or weeks, of severe headache, at first localised, but later extending all over the side of the head. The pain is accompanied by vomiting of the ordinary cerebral type. There is generally a single rigor, and the temperature is so little above the normal that the surgeon may be thrown off his guard if he trust too much to the thermometric indications. The discharge from the ear either diminishes in quantity, or may disappear entirely. The parents, looking only to the pain without taking the trouble to localise it, as a rule think that these symptoms are due to a fresh attack of the earache, to which the child has long been liable. They neglect to seek advice, and so this early stage of the disease rarely comes under the notice of the surgeon. In a few cases, a cerebral abscess is formed in connection with an acute inflammation of the middle ear.

The violent pain subsides after a time, but the patient is so listless and drowsy that he is kept in bed, and as long as he is recumbent he does not vomit. Examination now shows distinct evidence of intracranial pressure: the temperature becomes sub-normal, the pulse is slow and full, the respirations are slow and regular—slower and more sighing in cerebellar abscess than in the cerebral form. There is well-marked tenderness over the temporal bone on the affected side, and this tenderness is readily elicited by gently tapping the skull with the finger, but there is not necessarily any œdema or swelling. The breath is often fœtid, and there may be a rapidly advancing optic neuritis. An endeavour should be made at this stage to ascertain the position of the abscess, for Macbride believes that, if the conduction of sound by the bone is

impaired, owing to disease of the labyrinth, the abscess is more likely to be in the cerebellum than in the temporo-sphenoidal lobe of the brain. The condition of cerebral irritation, which is often indicated by twitching of the muscles, soon passes into paralysis; the patient becomes first stupid and then comatose, the pulse becomes quick, the temperature rises rapidly, convulsions occur, and death soon terminates the case, unless the abscess is emptied. Prof. Macewen states that he is able to elicit a differential cranial percussion note in children with cerebral abscess; the patient is supported upright in bed, and gentle percussion is made over the pterion on the two sides. I have several times endeavoured to elicit this difference, but my ear is not yet sufficiently trained to observe it.

Diagnosis.—The diagnosis of cerebral abscess has to be made from cerebral inflammation of a more diffuse nature, from diffuse serous meningitis, from infective thrombosis of the lateral sinus, and from cerebral tumour. The absence of delirium or nerve-paralysis, the low temperature until the later stages, and the absence of rigidity in the muscles of the neck, are the chief points by which to recognise a cerebral abscess. They are all negative, however, and they are merely symptoms of increased intracranial pressure, so that they are very apt to prove fallacious.

Prognosis.—The prognosis is always grave, for unless surgical treatment be adopted early, a cerebral abscess generally ends fatally. An untreated acute abscess runs its course in two to six weeks, whilst a chronic abscess may last as many months or years.

Treatment.—The treatment is prophylactic or curative. The prophylactic measures have already been dealt with (pp. 297, 298) in the simple forms; and if they fail, the parts must be rendered as thoroughly aseptic as possible,

in every case in which it is likely that a cerebral abscess may be formed. This, of course, is in every case of long-continued stinking otorrhœa associated with disease of the middle ear. The only way to meet this indication is to cut away a portion of the compact tissue, forming the front wall of the mastoid process, as soon as the ordinary methods of arresting the discharge have failed. There need be the less hesitation in doing this, as the operation is neither difficult nor dangerous, if ordinary care and skill be employed, and it is attended with the most satisfactory results. Professor Macewen, following Professor Schwartze's indications, states that it is justifiable to open the mastoid antrum when: (1) There has been repeated inflammation of the mastoid antrum and its cells, accompanied by swelling over the mastoid process, or when there is a fistulous opening in the bone, from which pus is discharging. (2) In acute inflammation of the mastoid antrum and its cells, with retention of pus. (3) When there are initial symptoms of intracranial disease, associated with chronic and purulent otorrhœa. Finally, where there is a persistent otorrhœa, especially if it be offensive, and if the discharge is mixed with bony particles or steatomatous masses. These rules apply equally to children and to adults.

Opening the Mastoid Cells.—The operation of opening the mastoid cells was first performed by J. L. Petit in 1750, though Jasser, a German army surgeon, usually has the credit of introducing it in 1776.

The mastoid antrum is the point to be aimed at in young adults, for it communicates on the one hand with the middle ear, and it is only separated from the middle fossa of the skull by a thin shell of bone. It is therefore one of the points through which inflammatory processes are most likely to extend directly from the ear to the dura mater. In children there is practically only a single

large cell in the mastoid process, so that the pus is obvious as soon as the outer wall of the bone is gouged away.

The patient should be properly prepared for the operation by shaving the side of the head the day before the operation, scrubbing it thoroughly with soap and water, and afterwards with ether. It should then be covered with a dressing soaked in 1 in 1000 solution of corrosive sublimate, kept in place by a gauze bandage until the operation begins. The parts should be again washed when the patient is under the anæsthetic, and rubbed over with a one pro mille solution of corrosive sublimate in alcohol.

A perpendicular linear incision is then made a quarter of an inch behind the posterior border of the external auditory meatus. All the tissues, including the periosteum, should be divided until the bone is reached, and it is a golden rule to expose the posterior bony edge of the external auditory meatus, since this border serves as a landmark throughout the operation. The cancellous tissue of the mastoid process must be exposed by gouging away the bone upwards and a little forwards, at the same time remembering that the bone is very thin, and that, unless great care be taken, the dura mater, the lateral sinus, and even the brain itself, may be exposed and injured. This is especially likely to happen in cases of long-standing inflammation, in which the outer layer of compact bone may become as dense as ivory. The cavity of the mastoid should be thoroughly cleansed, and any epithelial masses or caseating material should be removed. No drainage-tube is required if this be done thoroughly, and if the diseased skin be cut away with a scalpel. The side of the head is subsequently enveloped in antiseptic lint, with gauze bandages, and the wound is dressed frequently if there is much discharge.

During the operation the following anatomical points

may be borne in mind:—The facial nerve lying in the aqueductus Fallopii generally crosses the inner half of the floor of the mastoid antrum, running obliquely from without inwards; the lateral sinus is in very close proximity to the roof of the space, which is sometimes defective as a result of the ulcerative process, and consequently granulations in this region, which appear to be of the ordinary type, may in reality spring from the dura mater.

Professor Birmingham gives the following rules for finding, and for avoiding the lateral sinus in an adult: "The lateral sinus can always be exposed by a three-quarter-inch trephine, if its pin be placed an inch and an eighth behind the centre of the bony meatus, and in the line of its upper border. To avoid the sinus, a perforation behind the ear should be made, in front of a vertical line drawn a quarter of an inch behind the posterior margin of the meatus. The mastoid antrum can always be reached without wounding the sinus or entering the cranial cavity, if a quarter-inch drill is sent straight in at such a point that the anterior margin of the aperture it makes is as close as possible to the bony meatus, whilst its upper margin is not more than the one-twelfth of an inch above the level of a line prolonged horizontally backwards from the upper border of the meatus. It should be remembered that there is danger of wounding the labyrinth, if the drill be allowed to penetrate more than three-quarters of an inch into the base of the mastoid process." The position of the lateral sinus is very variable, and Professor Thomson has collected in the Museum of the Anatomical Department at Oxford a series of temporal bones from children, in which it may be seen that in some cases it would be impossible to trephine the mastoid bone without exposing the sinus.

Neither exposure nor pricking of the lateral sinus adds materially to the danger of the operation, though of course neither accident should be allowed to happen, if it can possibly be avoided. The bleeding from a small puncture in the lateral sinus is easily arrested by pressure with a pad of lint.

The operation of trephining is considered in detail on page 329. It is here sufficient to remember that the presence of pus is suspected when the dura mater bulges into the trephine hole, and when no cerebral pulsation can be felt. A pair of sinus forceps should be introduced into the cerebral substance after the dura mater has been incised. Trocars and hollow needles are useless as exploratory agents, for the soft brain matter blocks them. The abscess cavity may be gently scraped, and if the pus has been very foul it should be drained. No form of mercurial dressing or lotion should be employed, as mercurial salts are liable to form stable compounds with the cerebrum.

Mr. Ballance says that a trephine opening to explore the anterior surface of the petrous bone, the roof of the tympanum, and the petro-squamous fissure, has its centre situated seven-eighths of an inch vertically above the middle of the meatus, *i.e.* above Reid's base line. The trephine should be half an inch in diameter for an adult. A probe passed along the lower margin of the trephine hole, after the crown of bone has been removed, can be insinuated between the dura mater and the bone, so as to search the whole of the anterior surface of the petrous portion of the temporal bone.

Mr. Barker recommends that a temporo-sphenoidal abscess should be opened with a half-inch trephine, situated one inch and a quarter behind, and one inch and a quarter above, the centre of the external auditory meatus,

above Reid's base line; the probe being directed at
t inwards, and then a little downwards and forwards.
The trephine-opening for a cerebellar abscess should be
f an inch in diameter. Its centre should be an inch
a half behind, and a quarter of an inch below, the
tre of the meatus. Mr. Ballance says that the
erior border of the trephine should be just under
er of the posterior border of the mastoid process. The
rture in the skull is then so far away from the lateral
us that any instrument introduced into the substance
the brain may be directed forwards, inwards and
vards, until it reaches an abscess situated in the
erior part of the lateral lobe of the cerebellum, which
he usual site of collections of pus in this part of the
in.

CHAPTER XVI

INTRACRANIAL DISEASE AND ITS SURGICAL TREATMENT

THROMBOSIS OF THE CEREBRAL SINUSES.

Spontaneous Thrombosis.

Primary thrombosis is occasionally seen in the longitudinal sinus, and in the tributary veins in marasmic children up to the age of three or four years. It does not appear to give rise to very definite symptoms, for the children are sleepy; but there is no evidence of any meningitis. There may be some œdema of the nasal mucous membrane, with a little increased fulness at the root of the nose. They sometimes moan continuously. Death results from the constitutional condition, and is generally preceded by coma. No treatment is effectual.

Infective Thrombosis.[31]

Ætiology.—Secondary thrombosis of a cerebral sinus is always infective, and is generally pyæmic in origin. It is most frequently associated with caries or necrosis of the posterior wall of the tympanum, with meningitis, with cerebellar abscess, or with other infective lesions of the head and face. A purulent pachymeningitis is set up in the outer wall of the sinus, and this leads to the formation of a purulent thrombus. The cavernous and lateral sinuses, as well as the upper third of the internal jugular vein, are most frequently plugged, and often by a

suppurating clot. Gangrene of the lungs may result from the lodgment of infective emboli.

Symptoms.—The symptoms of infective thrombosis are usually sufficiently well marked to render the diagnosis easy. A severe pain radiates from the seat of inflammation, there is repeated vomiting, and a temperature which is remarkable for its rapid rise, and for its wide and irregular oscillations. Rigors recur at definite intervals, they are often severe and very prolonged. The pulse is rapid, small, and thready. The mastoid region may be swollen and tender, and in the worst cases the swelling extends upwards on to the scalp, and downwards along the course of the internal jugular vein, which may sometimes be felt as a more resistant cord in the neck. The patient complains of stiffness in the muscles at the back and side of the neck. Optic neuritis in varying degrees of severity is often present, and there may be some facial paralysis. The intellectual faculties, at first benumbed, are afterwards abolished, for the patient loses consciousness. Dyspnœa, with localised pain in the chest, marks the plugging of one of the smaller pulmonary arteries, which may be the first stage towards gangrene of the lung and the death of the patient.

Diagnosis.—Although the symptoms are usually so well marked that no mistake can be made in the diagnosis, yet it sometimes happens that they are sufficiently obscure to prevent its recognition even by those who are most familiar with it. The following case shows how easily this condition may be overlooked, owing to the ill-development of the symptoms, even when one is on the alert, for it occurred two or three days after I had written the above account. A child, aged nineteen months, came under my care to be treated for a mastoid abscess in June, 1894. Her father and one sister, out of a family of five,

were dead of phthisis. The mastoid bone was exposed, and much tuberculous granulation tissue was scraped away. The wound soon closed, and the patient was discharged. A month later she was re-admitted to the Victoria Hospital, suffering from diarrhœa. She vomited, but beyond screaming she gave no evidence of cerebral symptoms. She died two days afterwards, her temperature just before death suddenly rising to 108° F. It was found at the autopsy that, in addition to tuberculous disease of the viscera, she had a clot in the left lateral sinus, with such extensive necrosis of the petrous portion of the right temporal bone, that a round sequestrum as large as a sixpence lay loose in the brain case.

Secondary thrombosis may also be mistaken for an attack of typhoid fever, from which it may be distinguished by the repeated rigors and by the oscillating temperature marking the pyæmic condition.

An acute inflammation of the middle ear, leading to the formation of an abscess which bursts through the mastoid and tracks down the neck, is liable to be mistaken for secondary thrombosis, but the swelling is situated farther back in the neck, and the jugular vein remains unaffected. In such cases the patient is conscious, and although there may be severe rigors, the temperature is not so high in the intervals.

Prognosis.—The prognosis is always serious, and in cases where thrombosis of the lateral sinus is suspected, and the mastoid vein is plugged, the sinus should be explored at once; for only in very exceptional cases does the abscess burst and discharge immediately through the mastoid, or mediately through the antrum.

Treatment.—The internal jugular vein should first be exposed in the neck, ligatured below the thrombus, and it should then be divided, for this will prevent the

extension of the thrombosis, and
embolism occurring during the op
with the clot. The blocked port
opened and irrigated if necessary
gauze is then placed over the wo
at once.

The lateral sinus is then explore
This should be done by turning do
including the pericranium, one poi
mencing immediately behind and
being carried backwards for a suf
a ⅝-inch trephine to be worked
sinus (fig. 35) runs from just belo
occipital protuberance, horizontall
it reaches the parieto-occipital su
sharp turn downwards on to th
mastoid vein or veins open oblique
part of the sinus, which again cur
reach of surgical interference. If
be placed over the skull at the
vein enters, there will be no dif
sinus, for the vein opens direc
through the skull on a level with
that in an adult the trephine
lateral sinus should have its centr
quarter of an inch above, the midd
i.e. above Reid's base line; but ir
which my figure was drawn, it wa
pin of the trephine upon the base
35 D. A trephine is used measu
inch in diameter, and the openi
be extended forwards with a go
so as to open up the mastoid cel
fully laid open as soon as the c

removed. Its cavity is cleared, and rendered as aseptic as possible by flushing it with a solution of perchloride of mercury 1 in 2000, at a temperature of 105° F. The wound is then freely drained, and both it and the one in the neck are dressed antiseptically.

Death in untreated cases usually takes place within three weeks, from gangrene of the lung or from general pyæmia.

CEREBRAL MENINGITIS.

Ætiology.—Inflammation of the cerebral meninges is always infective in origin. It is either simple or suppurative, primary or secondary. Idiopathic suppurative meningitis may occur from many causes, the most frequent being tubercle. Recent researches show that it may be produced as a primary or secondary affection by pneumococci, streptococci, staphylococci, and the bacillus coli. The meninges of the brain are directly involved in the primary affection without the production of any general disease, such as typhoid fever, pneumonia, abscesses, or furunculosis. Secondary meningitis, on the other hand, occurs in the course of one of these general diseases, in endocarditis, in influenza, or, it may be, after a compound fracture of the skull.

Non-Tuberculous Meningitis.[32]

These forms of non-tuberculous meningitis are therefore either pyogenic or non-pyogenic in origin. They usually affect the convex surface of the pia mater, and they are generally bilateral, although if they originate from a specific focus, as from a fracture, or from middle ear disease, the inflammation may be confined to one hemisphere. The special form produced by pneumococci is said to be nearly always cerebro-spinal, and it is perhaps the cause of the epidemic cerebro-spinal meningitis, which occasionally

sweeps over countries with the
plague. The effusion is often ve
and plastic in character, and m
green colour, with a peculiar si
cases it is thin and serous, an
properties. The inflammation s
lymphatic system, and the micro
found in the peri-arterial lympha

Symptoms.—The symptoms
startling rapidity, and this absen
distinguishes the less common
gitis from that produced by tuber

There is a short stage of excite
of 103–4° F., headache, vomitin
stipation, and inequality of the p
greatly during the attack: at o
another time slow; at one time
intermittent. There is delirium
followed by convulsions, retractio
due to tonic contractions of the m
one or more of the cranial nerve
plegia. These symptoms termi
Stokes' breathing, relaxation of t
of the pupil, and death. The
acute course, but it is sometimes s

Diagnosis.—The diagnosis is
symptoms may be present, and
meningitis can be discovered. Th
ingitis has to be distinguished
common tuberculous form. Dr.
believe that cervical opisthotonu
non-tuberculous basal meningitis,
form it is an accidental symptom.
tion, and becomes more pronounced

into an erect position. It is, however, inconstant, and may be absent entirely, or being present, it may disappear whilst the inflammation still progresses.

Prognosis.—Recovery may take place spontaneously, or after an operation to relieve the intracranial pressure by providing an exit for the cerebro-spinal fluid. Death, however, is by far the most frequent ending.

Treatment.—The indication for the palliative treatment of these cases is to get rid of the source of infection if it be possible. This is best done by disinfecting the alimentary canal. The mouth must be frequently washed out with a saturated solution of creolin, whilst β-naphthol is given every three hours, in one-grain doses administered in milk, or one and a half to three grains of naphthaline as a powder, if it be preferred.

The operative treatment consists in trephining (p. 329) the skull when it is possible to localise the inflammation, or if there is evidence of acute distension of the ventricles. The operation, therefore, should always be performed when the inflammation is associated with a fractured skull, and when hemiplegia supervenes after a trivial injury to the scalp, even though the symptoms do not come on for five or six weeks.

Tuberculous Meningitis.

Ætiology.—Tuberculous disease of the brain and its membranes is usually secondary to tuberculous disease of the thoracic and abdominal organs, and of the mesenteric glands, even though the cerebral symptoms do not appear until the primary disease is cured. It may originate in a tuberculous inflammation of the middle ear: much more rarely it is in connection with tuberculous joints, bones, or superficial lymphatic glands. In a few instances it seems to be truly primary in origin.

Pathology.—The pia mater at
chiefly affected. Miliary tubercle
the fissure of Sylvius and in the v
latter, by the inflammation to whi
to blocking of the venæ Galeni
disturbance, causing distension
cerebro-spinal fluid. This produ
pression as to cause death. Ca
found in the substance of the
the cerebrum in these cases. Th
been long antecedent to the men
they are sometimes calcified. T
symptoms.

Symptoms.—Prodromal symp
in tuberculous meningitis than
forms. They are often trivial.
child's irritability, listlessness, sli
exaltation of cutaneous sensibility,
vomiting, and a slight but intermi
sole indications of the deadly pro
skull. The temperature is only
for it is often not more than 9
symptoms manifest themselves af
weeks, or months. There is sudde
with an agonising headache, often
panied with the peculiar piercing
described as the "hydrocephalic c
becomes more marked, slight soun
is photophobia, and the pupils are
remission often takes place in t
provement is nearly always delusi
pupils dilate, the temperature ris
ably variable, the pulse becomes ir
Stokes' respiration. General or

place; but soon the coma deepens, the paralysis becomes more and more marked, there is loss of control over the sphincters, the temperature rises rapidly, and the child dies.

Diagnosis.—Tuberculous meningitis has to be distinguished from the other forms of infective cerebral inflammation, as well as from the pressure effects caused by injury and tumours. The tuberculous inflammation is so common in children, and other evidence of tuberculous disease is so easily obtained, that there is rarely any difficulty in distinguishing this form of meningitis. The history of hereditary tubercle, the gradual onset, the rapid loss of flesh, and the irregular temperature, go far to verify the diagnosis. Too much reliance must not be placed upon the results of ophthalmoscopic examination, for many cases of tuberculous meningitis run their course without giving rise to visible intraocular changes. The surgeon must be constantly on his guard; for although the diagnosis of tuberculous meningitis is usually easy, he should remember that few diseases assume so protean a form, and in few is the course so often atypical. The diagnosis, however, may be rendered absolute by finding tubercle bacilli in the cerebro-spinal fluid obtained by puncture of the vertebral canal in the lumbar region in the manner described on page 322.

Prognosis.—Death is so certain in these cases that the treatment of tuberculous meningitis can only be considered palliative.

Treatment.—The cause of death appears to be the intracranial pressure, often exaggerated by the vascular disturbance caused by venous obstruction. Trephining the skull has therefore often been practised for its relief. One case which fell under my immediate observation was, I believe, cured by the operation.

A girl, aged five, suffering fr
tuberculous meningitis, appeared t
the stage of coma, with paralysis.
mined to drain the subarachnoid s
The trephine was placed upon th
halfway between the occipital cre
cess. The dura mater bulged f
crown of bone was removed. It
drops of cerebro-spinal fluid escape
mediately filled the trephine hole, a
of more fluid. A silver probe pas
falx, between the cerebellum and
several drachms of serous fluid
tube was then passed along the p
between the brain and its membra
was replaced. The crown of bon
in warm boric solution, was broke
placed over the dura mater, and
A free discharge of cerebro-spinal
after the operation. The child ra
ately began to improve. She was
and she has since paid many visi
case, which was under the care o
and Mr. Waterhouse, is recorded
actions of the Medical Society for
peated the operation several tim
relief; but no other case has been

PUNCTURE OF THE VERT

Ziemssen in Munich and Dr. E
have recently advocated puncture
and evacuation of the cerebro-spina
culous meningitis. Quincke has s
in children of one year old the sp

second lumbar vertebra, whilst in the newly born child it extends to the third, and he has advised a similar puncture for the relief of hydrocephalus.

The child is held in a sitting position, with his back turned towards the surgeon. He is then bent forward to make the space between the vertebral arches as large as possible. A minute incision is made through the skin between the third and fourth lumbar vertebræ, and just to one side of the spinous process. A very fine trocar and canula, which have been freshly boiled, is then pushed in through the skin incision until it impinges upon the lamina, when its point is directed somewhat downwards, and it is driven through the ligamentum subflavum and the theca towards the middle line for a distance of a little less than an inch. The trocar is withdrawn whilst the canula is left in place, and clear cerebro-spinal fluid at once escapes. The nerve roots forming the cauda equina in young children are usually collected into two compact bundles lying upon either side of the vertebral canal, so that there is very little danger of injuring them.

The surgeons who have used this method most extensively report favourably upon it, for they all agree that temporary relief is obtained which might be permanent if it were possible to establish a fistula through which the cerebro-spinal fluid escaped constantly. The operation is a trivial one if everything is kept aseptic, and it appears to be well worthy of a more extensive trial, as it is of great diagnostic value. Hirschberg objects to the method, on the ground that it is impossible to drain the skull through the vertebral canal under the conditions which are present in tuberculous meningitis. The objection is a theoretical one, and it has yet to be proved whether it is founded on a basis of fact. He prefers, like many other surgeons, the operation of trephining for the relief of these cases.

TREPHINING

The cases of meningitis to be must be selected with care. The with active tuberculous mischief organs are unfitted for operative a constant source of infection. disease are also unsuitable. Goo be obtained when the case is seen ingitis is primary in origin; when pleurisy or peritonitis, from which taken place; when it is associated phatic glands which can be remove it is in connection with an otorrh treatment; and when it is due fracture, leading either primarily formation of a cerebral abscess. reasoning which leads us to open cases of tuberculous peritonitis le fluid in cases of tuberculous meni tions are still in a state of probatio

THE CEREBRO-CRANIAL CHILDREN

The cranio-cerebral topography carefully worked out by Fouille results have been verified and a differences in the adult (fig. 33) a are not great. The chief points of bregma in the child lies close to t anterior fontanelle. The upper end is situated either at, or a little in the adult, for its upper end during is from 30 to 35 mm. behind th posterior diameter of the brain b

42·43 mm. behind the bregma during the second to third year, and after this age it rapidly assumes the same relations as in the adult. The lower end of the fissure is proportionately higher until the third year, after which it falls to the adult position. The fissure is therefore situated somewhat higher up and a little farther back in children than in adults. The fissure of Sylvius is a little more oblique in children up to the third or fourth year, and lies higher above the squamous suture than in adults. Its posterior branch lies either just under the squamous suture at its highest point, or ½ to 1 cm. above it. It runs up to, and usually above and in front of, the parietal eminence, *i.e.* the parietal eminence in children is relatively lower than in adults.

The parieto-occipital fissure is either exactly under the lambda or 1 to 2 cm. in front of it.

Exploration of the Cerebral Ventricles.[35]—The operation of draining the ventricles has been performed for compound fracture of the skull with secondary implication of the ventricles, and for the relief of acute hydrocephalus. It is useless in chronic cases. The operation was first proposed by Wernicke in 1881, though puncture of the brain for the relief of hydrocephalus dates back to the time when Stevens proposed that it should be employed in the case of Dean Swift in 1744. It was first carried out by Zenner, of Cincinnati, in 1886. It has since been elaborated by Keen in America, and by Broca in France. It appears to be more satisfactory to drain the ventricles laterally than either through the anterior or the posterior horns. Keen gives the following directions for finding the different parts of the lateral ventricle in the adult; and so far as I have proved them in children, they are sufficiently correct for all practical purposes.

(1) Trephine (fig. 35 B) halfway between the external occipital protuberance and the upper end of the fissure of

Rolando, at a distance of $\frac{1}{2}$ to $\frac{3}{4}$
the middle line. Puncture toward
supraorbital ridge of the same si
pass through the precuneus, and t
be struck at some point in the po

FIG. 33.—Skull showing the position of th
adult (cf. fig. 34) with Reid's base-line. *A*, Gla
tuberance; *e.a.p.*, external angular process o
fissure; *Sy. fis.*, fissure of Sylvius; *Sy. h. fis*
of Sylvius; *Sy. a. fis.*, ascending limb of the f
dicular line from depression in front of exte
line of top of head; *F*, *G*, perpendicular line
mastoid process to middle line of top of head
fis., parieto-occipital fissure; + most promin
(Copied by permission of Prof. Reid from the

of $2\frac{1}{4}$ to $2\frac{3}{4}$ inches from the surfa
method gives the best drainage.

(2) Measure the distance from the glabella to the upper end of the fissure of Rolando—a distance of about 6 inches in a child aged two years. Trephine at the junction of the anterior and middle third of this line and ½ to ¾ inch away from the middle line of the skull (fig. 35 A). The puncture will traverse the first frontal convolution well in front of the motor zone, and the normal ventricle will be struck in the anterior horn at about 2 to 2½ inches below

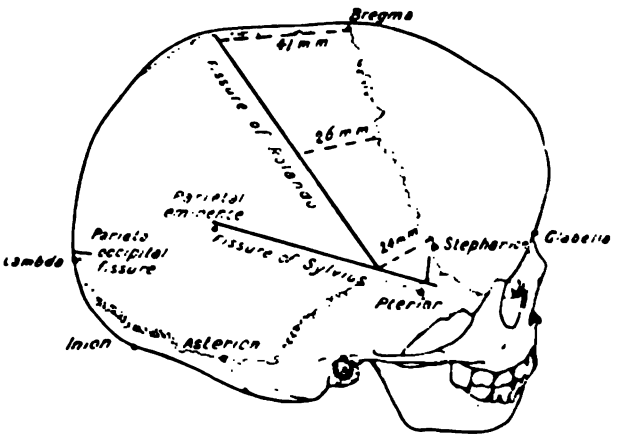

FIG. 34.—Outline drawn from the skull of a child, aged about three years, to illustrate the main points in the cranio-cerebral topography of children. The position of the lambda and inion are only approximate, as they cannot be seen in a side view. The skull is tilted laterally to show the sagittal suture. Its antero-posterior measurement from the glabella to the inion was 287·5 mm.

the scalp. The objection to this method is the real one, that it leaves a scar on the forehead; and the theoretical one, that injury might be done to the corpus striatum. It is serviceable, however, in a compound fracture of the skull, when there is reason to believe that the ventricle is distended with blood.

(3) Trephine 1½ inch behind the posterior margin of

the external auditory meatus ar
base-line (fig. 35 C), *i.e.* a line dr
inferior border of the orbit throug
ternal auditory meatus to the occi
a point just above the external
opposite side. The puncture w
temporo-sphenoidal convolution, a
lateral ventricle at the beginning
descending cornu at a depth of abo

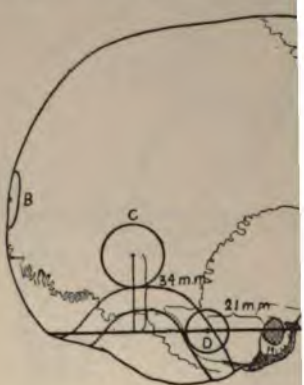

FIG. 35.—Outline drawn from the skull of
It shows Reid's base-line passing through the
meatus, and the curved outline of the later
which to trephine for the purpose of explo
through its anterior horn; *B*, point to trephin
ventricle through its posterior horn; *C*, poin
right lateral ventricle through its lateral horn
ing the lateral sinus in cases of infective thro

surface. This is the method best
as it allows a temporo-sphenoidal
if it be found in the course of the
has been made in the diagnosis.

Trephining is neither a difficult nor a dangerous operation. The head must be shaved and thoroughly cleansed overnight, and an antiseptic dressing should be applied until the time of the operation. The surgeon, having selected the point at which he proposes to trephine, makes a semicircular flap, cutting down to the bone. The convexity of the incision is directed upwards, as there is less hæmorrhage, owing to the arteries being divided farther away from their origins. As soon as the bone is exposed, the surgeon places the pin of a ¾-inch trephine at the point where he desires to expose the meninges. He works his trephine with care until a good groove is formed in the bone, when the centre-pin is withdrawn or, better still, is removed. Great care must be taken to divide the bone evenly at each part of its circumference, or the dura mater may be lacerated. The application of a thin raspatory or periosteal elevator will enable the crown of bone to be removed easily when it has been cut through. If the dura mater is tense, elastic, and does not pulsate, it may be assumed that the ventricles are distended. The dura mater should be incised in such cases, and the brain explored with a grooved director. The clear fluid readily flows out, and with considerable force, if the ventricles be distended. The rapid evacuation of fluid from the ventricles does not seem to be attended with any evil results, and quite recently I removed two and a half ounces from one ventricle with marked temporary improvement in the pulse and respiration. The ventricles may be drained through the brain by inserting into them a drainage-tube of stout rubber, or, better still, by a small bundle of horsehairs, for the tube is apt to get clogged. The wound is then closed with point sutures, and antiseptic dressings are applied. I do not consider it necessary to replace the crown of bone either wholly or in fragments, for trephine holes in children

soon begin to diminish in size. I
curial dressings and lotions in
theoretical objection that they m
the brain substance.

CEREBRAL T

Intracranial tuberculous dise
either occurs as a tumour embe
stance, or as a miliary tuberc
The two forms are only combi
symptoms of embedded tumours
absence of fits, paralysis, or sick
paired vision due to optic neuriti
a very marked symptom. Thes
ease, however, are unfitted for
tumours are large, often deeply
that they could not be completel
estimates that 25 per cent. of
the brains of children are tuberc
comata form nearly all the rest.
lend themselves readily to opera
sent conditions, so that the surg
tumours in children as yet hardl

CHRONIC HYDRO

A considerable number of the
under the notice of the surgeon t

Treatment. — My own routi
severe cases is to draw off the fl
tricles by puncturing at the out
fontanelle with a fine and thor
canula. The instrument should
a little backwards. It is, I th
fluid by repeated punctures than

up cerebral symptoms by withdrawing the whole of it at one time; for the intracranial conditions here are very different from those in acute distension of the ventricles. The child is to be properly prepared overnight by having his head shaved, cleansed, and bandaged, as though he were to undergo a serious operation. The skin should be divided with a scalpel, to prevent any particle of unclean epithelium being carried into the ventricles on the end of the trocar. A piece of cotton-wool soaked in collodion is sufficient to close the wound when the operation is completed. The operation is useless in children whose skulls are firmly consolidated.

The Treatment of Microcephalus and Idiocy.

The operation of craniotomy in all its forms for the treatment of microcephalus and idiocy has proved so unsuccessful and so dangerous in all the cases which I have had an opportunity of observing, that I do not consider it a legitimate surgical procedure. The excellent results obtained by a judicious process of education show how much can be done to ameliorate the condition of these unfortunate children.

Treatment of Meningo-Encephalocele.

There is no reason why these cases of pulsating tumour springing from the site of a fontanelle should not, in the case of healthy children, be removed by the ordinary aseptic methods. Care must of course be taken that the wound should heal by first intention, and that an aseptic ligature be placed round the sac. Several successful cases are recorded. The operation may be done in two stages, the first to draw off the fluid, and the second to remove the brain substance if it cannot be kept in place by pad and bandage, or other form of truss.

CHAPTER

SURGICAL DISEASES OF

DIPHTHERIA IN ITS SU

Pathology. — Scientific inquir
themselves that diphtheria, lik
diseases, is really of several type
virulent is associated with the
ganism known as the Klebs-L
more common type is due to a
with many forms of septic organ

The Klebs-Löffler bacilli are m
slightly bent, and of the same a
bacilli, but from one and a half t
vary materially in shape and
The simple bacilli are usually cu
to find wedge-shaped bacilli an
They are frequently divided i
fixed, and possess no spores. Th
method and with Löffler's alkali
staining more deeply than the
aërobic, and thrive best at the
viz. 98 to 100° F., on a mixture o
bouillon. They are found on the
brane, or in its substance, but t
from the true mucous membrane
taining leucocytes. Dr. Dillon F

ready method of detecting this bacillus is to detach a small piece of membrane and place it for five minutes in a 2 per cent. solution of boric acid. The piece of membrane is then drawn along the surface of sterilized blood serum in a test-tube, and the serum is afterwards maintained at a temperature of 98° F. If bacilli are present, characteristic small white and rounded colonies are visible along the track of inoculation, sixteen hours after it has been made. The centre of the colonies are more opaque than the periphery, and they grow so rapidly that they are usually well formed before any other micro-organisms have begun to form colonies at all visible to the naked eye. A second or third preparation, however, must be made before a pure cultivation is obtained. The virulence of the cultivations becomes successively diminished if they are grown on agar-agar, but not if they are cultivated on serum.

To overcome the difficulty of obtaining sterilized serum, Sakharof suggests the use of hard-boiled eggs, from one end of which a part of the shell has been removed with ordinary forceps, so that the shell-membrane can be peeled off, to allow of the necessary inoculation being made. To guard against contamination, the egg can be turned upside-down in a common egg-cup, the interior of which has been sterilized by allowing the flame of a spirit-lamp to enter it for a second or two.

Dr. Ball advocates growing the bacilli upon blood-clot which has been sterilized by boiling the blood in a test-tube kept in a water-bath at 212° F. for ten minutes, or until it has become quite solid and of a chocolate colour. He claims that the greyish-white colonies are better seen on a dark background than when they are grown upon a transparent surface. It should be remembered, however, that the growth of the organisms is much slower when

they are cultivated on a medium
a temperature of 212° F.

The bacilli in pure cultivati
producing membranous exudatio
cous surfaces of the body. T
substances or toxines capable
symptoms when they can gain a
or lymphatic channels, and thro
These toxic products, however,
when they are introduced unde
to diphtheria, for many persons
to their effects. They act espec
nerves, causing segmental neurit
leading to fatty degeneration.

The pure and the mixed forms
times clearly defined in the rare
an attack of diphtheria. The n
serous arthritis and the periarth
products of the pure bacillus, wh
suppurations are the results of t
junction with septic microbes.
mortality of the various outbre
attributed to the same cause.

A knowledge of these pathologi
to great alterations in the recog
ment of diphtheria. It has sho
ing diphtheria as a local disease,
is in reality outside the body; so
destroyed, the poisonous bodies
and growth can be effectively d
themselves. It should, however
every croupous inflammation of a
no means to be considered as true
only certain means of diagnosis

inoculation upon guinea-pigs and pigeons, and of bacteriological examination, which requires an elementary knowledge of the ordinary methods employed in bacteriology. The bacteriological examination, however, is of great importance in regard to prognosis; for the fewer the bacilli present, and apparently the smaller they are, the less severe will be the attack.

Treatment. *By Antitoxin.*—A certain degree of immunity from diphtheria can be conferred upon animals for a short time by inoculating them with attenuated cultures of the Klebs-Löffler bacillus, or by injecting a suitable quantity of the serum of an animal who has suffered from the disease in some form which has conferred immunity upon it. The means by which this immunity is obtained are as yet unknown, but it is perhaps due to the formation of antitoxins produced by the cellular elements of the connective tissues. In April, 1893, this method of treatment was extended by Behring and Kossel from animals to human beings, for they inoculated the serum of immune goats into thirty diphtheria patients, of whom twenty-four recovered. The method has rapidly become fashionable. It has been suggested that it may be used as a preventive measure in the case of children who have been exposed to the risk of contagion, in which case only a small dose is required; but hitherto it has been chiefly employed as a curative method for those actually affected with the disease, when a much larger dose is required. The results appear to have been satisfactory, and the method has been highly recommended, though we still require further evidence of its utility in extensive epidemics. Too much, however, must not be expected of it, for it does not protect the individual for any length of time, nor does it in any way influence the action of the septic micro-organisms which play so large a part in the phenomena of ordinary

cases of diphtheria. Inoculation
which is now made with horse's
probability be found serviceable
of unmixed diphtheria.

The method of inoculation is
usually made under the skin of t
first be washed with a 1 in 20
The hypodermic syringe must
immediately before the inoculat
The dose for a child weighing t
centimetres, which is equivalen
in one dose under the skin. I
metres may be again inoculated
any case it is advisable to injec
four hours after the first inoculat
has been used is to be boiled for
tion may lead to a little swelli
usually subsides in a few hours,
tenderness for a day or two.

It is maintained by Heubner
toxin can be introduced with
when diphtheria is only suspe
being an erythematous rash wh
per cent. of the cases from seve
the injection; but Hansemann,
method of treatment, states tha
may result from its adoption, w
observed slight arthralgia, the h
attacked.

By Fumigation. — Dr. Nortl
cated the method of calomel fum
of acute laryngeal stenosis occur
originally introduced by Dr. J. C
1881.

A tent-cot is made in the ordinary manner, of such a size that it contains 50 cubic feet of air. A lighted spirit-lamp is placed in a wash-hand basin or in a chamber-pot, and a strip of tin is bent across it. Fifteen grains of *chemically* pure calomel are heaped upon the strip of tin where the flame of the spirit-lamp touches it. The sides of the cot are closed for a quarter of an hour, and the room should then be freely ventilated. Dr. Northrup recommends that the fumigations should be repeated in severe cases at intervals of two hours for two days and two nights, the intervals being prolonged to three hours on the third day, four hours on the fourth day, and subsequently three times a day. There is more or less anæmia after prolonged fumigation, but children do not become salivated though they have diarrhœa, and, if the calomel is mixed with corrosive sublimate, there may be some conjunctivitis.

In the simpler forms of diphtheria an ice-collar may be applied to the throat, and a 4 per cent. solution of chlorate of potash should be used every hour as a gargle, or it may be sprayed into the throat and nostrils of a child who is too young to gargle. Hahn, too, recommends that in the early stages of diphtheria half a pint of a warm 2 per cent. solution of boric acid should be injected into the rectum.

Operative Treatment. *Indications for surgical interference.*—The surgeon is not usually called upon to make a diagnosis of diphtheria, but he is frequently summoned to relieve the symptoms of acute laryngeal dyspnœa. The dyspnœa comes on gradually: at first there is a little languor with feverishness, and a peculiar "croupy" cough. The movements of the larynx soon become exaggerated, and the characteristic furrow of inspiratory recession becomes marked. It is best seen on the front of the chest at the level of the ensiform cartilage. At each

inspiration the supraclavicular s
hollowed. The breathing in unc
laboured than hurried. Attack
velop; they are paroxysmal at fi
periods of comparative ease; but
the respites become briefer and
restlessness increases, the face a
blue. Finally, as the lividity i
diminishes, the features assume
becomes comatose and dies.

No child should be allowed to
urgent dyspnœa is the great sym
interference; and when it is pre
tion is performed for its relief th
patient.

Children bear dyspnœa very
if the condition be not removed o

The two great means of affo
suffering from dyspnœa are intu
Either operation may be perfor
creasing and persistent dyspnœ
struction in the larynx and uppe

The symptoms by which the u
measured are recession of the s
ing inspiration, stridulous breath
W. Parker's axiom should be rem
the child the less we can afford
relieve the dyspnœa.

Choice of Operation.—The
decide very promptly whether he
or tracheotomy. His decision mu
not intubate with the idea that
formed afterwards; for when thi
tality has been found to be pr

especially adapted for those cases of laryngeal obstruction which are acute in onset and transient in duration, as in scalded throat, or œdema of the larynx, if the case is seen early, in acute laryngitis, and in sudden spasm of the glottis. It has also been successfully performed for cicatricial stenosis after tracheotomy, and in the contraction following the various forms of ulceration of the larynx, whether it has been due to the exanthemata or to syphilis.

Intubation for the relief of dyspnœa in diphtheria is best suited for those cases in which there is great dyspnœa with comparatively slight constitutional symptoms, and without the formation of much membrane. Intubation with the ordinary O'Dwyer's tubes is not adapted for cases in which the trachea is filled with membrane, nor should the operation be performed when the naso-pharynx is extensively involved. It is especially useful in children under two years of age, and it has the additional advantage of not requiring an anæsthetic or an incision. This is advantageous to the surgeon in several ways, for it often allows the operation to be done earlier than the child's relatives would otherwise permit, hæmorrhage is avoided, there is no chance of the condition being rendered worse by wound infection, and the air is naturally warmed and filtered before it enters the lungs, so that there is a diminished risk of pneumonia. Intubation, on the other hand, requires somewhat greater skill on the part of the operator for the neat and effective introduction of the tube. He should always be at hand, as the tube is sometimes coughed out, and in urgent cases there is danger of suffocation if it be left out even for a short time, although it often happens that after removal of the tube there is complete temporary relief of the symptoms of dyspnœa, apparently due to the pressure exerted by the tube leading to a diminution of the œdematous swelling. This temporary improvement is

apt to prove fallacious unless its t
Intubation therefore appears to
dren in a public institution or
obtained without delay. Mr. S
surgeon, showed some years ag
quantities of membrane and of te
discharged through an intubate

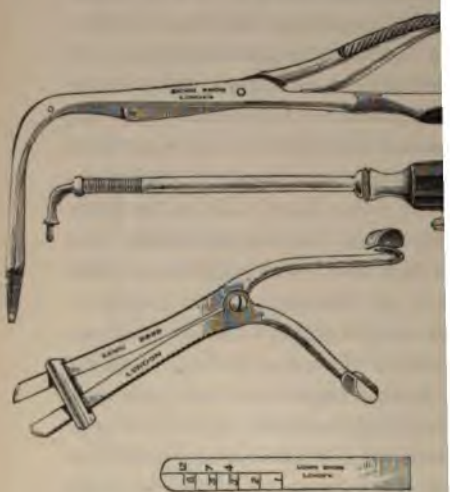

FIG. 36. — Instruments employed during O'Dwyer's method.

vations have been fully confirme
occasion to perform the operation

Intubation of the Larynx.—
bation of the larynx[36] as opposed t
originally proposed by Bouchut in
duced by O'Dwyer in 1885. The i
tion are urgent and progressive
chiefly acting above the vocal cord

The instruments represented in fig. 36 are required in O'Dwyer's operation, of which alone I have had any experience. They are a gag, two or three tubes, an introducer (the second instrument from the top), on to which the pilot or obturator is screwed, the pilot varying in size for each tube, and some stout silk. The tracheotomy tubes and instruments should also be in readiness. The tube is a stout perforated piece of metal with an expanded end, provided with a small hole, through which a silk ligature can be passed to recover the tube in case it should fall into the œsophagus whilst it is being introduced. The tubes are made self-retaining by increasing their narrow transverse diameter at the centre, so as to make them nearly cylindrical in the middle, whilst they taper off at the ends to form a double wedge. In buying them, care should be taken to see that the pilot projects a short distance beyond the lower end of the tube, and also that the lower end is stout and very blunt, as a sharp edge sometimes causes troublesome symptoms. An indicator, represented in the figure, is supplied to enable the surgeon to ascertain the appropriate-sized tube to use. A tube which reaches from the bottom square edge of the indicator to the figure 1 is suited for an average child of twelve months old, that which reaches from the bottom to the figure 3 is for a child of three years old, and so on up to twelve. It should be borne in mind that the tubes are made for an average child, and they are usually too small for the individual, so that it is better to take a size larger than the index points out; for if too small a tube be selected, there is a danger of its being coughed out too easily.

The tube is threaded with a silk ligature, measuring about 18 inches in length, and passed through the hole in its expanded end. It is then warmed and placed upon the pilot, which has been previously screwed on to the

introducer. Two assistants are necessary. The child, as in the annexed diagram (fig. 37) is held upright in front of the surgeon by one assistant, whose duty it is to hold him firmly and prevent movements of his body. The best plan of keeping him quiet is to wrap a sheet or rug round him so as to include his arms. A gag is

Fig. 37.—Semi-diagrammatic representation of the method of introducing an O'Dwyer's tube for intubation of the larynx.

then placed in the left-hand corner of his mouth and is handed to the second assistant, who holds it firmly, and at the same time steadies the head in such a position that it is neither fully extended nor yet flexed upon the sternum. The surgeon then takes up the introducer in his right hand, and winds the thread attached to the tube round his little

finger. He pushes his left index finger down the throat until he is able to raise the epiglottis and feel the rima glottidis. The introducer, with the tube at its end, is held in the right hand, so that it first lies parallel with the patient's chest; the handle is then rapidly elevated, and the tube, guided by the left index finger, is passed lightly into the larynx. As soon as the tube is well in position, it is pushed off the pilot by pressing a lever in the handle of the introducer, which is then withdrawn. The tube must be well pushed home until its expanded end lies upon the top of the glottis, or there is a tendency for it to be expelled by coughing; and a hold must be retained at the same time upon the silk, lest during the manipulation the tube pass into the œsophagus instead of into the glottis.

The operation is rapidly and accurately performed with comparatively small practice; and for the purpose of acquiring a sufficient amount of dexterity, Prof. Heubner has described a phantom or model in the *Jahrb. f. kinderhk.*, vol. xxxvi., p. 161. The introduction of the tubes should never take more than half a minute, and it can readily be accomplished in eight to ten seconds. No force must be employed. The silk thread attached to the expanded part of the tube may be secured by looping it round the ear; or, if the tube is to be left in the larynx for any length of time, it may be removed after an interval of a quarter of an hour, when the first fit of coughing has subsided, and as soon as the surgeon has assured himself that the respiration is satisfactory. The gag must then be re-introduced, the string cut, and the surgeon should keep his finger on the tube until the string is pulled out. The tube, which was only allowed to remain for twelve hours at most when the operation was first suggested, has been left in the larynx for longer and longer periods, until at the present time three or four days

are often allowed to elapse befo
any symptoms arise to render its

Treatment after Intubation

too soon, sudden and urgent dy
and this needs a speedy re-introd
surgeon should not be in too g
child after he has extracted the t
first half-hour it seems to breat

A child who has been intuba
and in a room at a uniform te
feeding constitutes the great d
every care children take much
than after tracheotomy. Soft-boi
made with milk, well-boiled b
essence with brandy, usually fo
solids are taken more easily th
tendency to pass into the laryn
(fig. 38), copied by the kind per
his excellent work on intubation
which the food must be admi
placed either upon its back or o
the head lower than the body. V
small pieces of ice to suck will al
constant a symptom of these infla

When there is much clogging o
membrane, the nostrils must be
cleansed by means of a probe arm
wool soaked in a 1 or 2 per ce
peroxide, alone or mixed with tw
water; or a 1 in 40 solution
Jacobi recommends that these sol
injected from a small glass sy
nozzle of soft rubber. The local
be applied in a recumbent or sem

the child should not be taken out of bed more frequently than is necessary.

Sequelæ. — Intubation in a few cases has been followed by extensive ulceration, with necrosis of the

FIG 39.—Method of feeding a child after intubation of the larynx. (Copied by permission from Dr. Ball's work on Intubation.)

cartilages; but this is fortunately quite exceptional. The tube has fallen into the trachea, and has had to be removed by tracheotomy, and it has been swallowed, but without any bad result. Careful selection of a tube of the proper size will render these accidents less likely to occur.

Death sometimes occurs during
or the dyspnœa is so urgent tha
withdrawn and tracheotomy perf
cases the physical signs in the c
examined two or three times a day
left in the larynx.

Removal of the Tube.—The
always more difficult than its intr
necessary to give the child an
should not be done if it can be
placed in the same position as for
tube, if it is to be removed without
gag is introduced, and the surge
finger down the throat until he fee
lying in the glottis. He takes the
hand (represented in fig. 36 as the
The extractor consists of a pair of
serrated upon the outside. The ins
the finger until the points are felt
of the tube; it is then pushed w
opened, and the tube is withdra
extractor must be carried well d
child's chest, or considerable diffic
in getting the tube past the soft
gentleness and patience are requir
serious damage may be done to t
rounding parts by even a slight a
Staveley has attached a small rin
troducer, so that the thread from
through it, and thus give more co
tube than can usually be obtained.

Results.—The mortality in case
by intubation appears to be nea
after tracheotomy. Drs. Prescott

that in 2,815 cases of intubation recovery took place in 32·2 per cent., whilst after 23,941 cases of tracheotomy there were 28·67 cured. The tube in their intubation cases was worn for an average period of five days and eighteen hours, and they say that age has a decided effect upon this time, for the younger the child the longer must the tube be kept in the larynx.

Tracheotomy,[37] **History.** — The air-passages were opened by Asclepiades of Bithynia a century before Christ, and the operation was performed and recommended by Antyllus at the end of the third or beginning of the fourth century. It was reintroduced in the sixteenth century by Benevieni and Fabricius ab Acquapendente; but the modern operation only dates from the time of Bretonneau and Trousseau, who in 1825 and 1833 respectively performed it for the relief of diphtheria.

Indications. — Tracheotomy is performed either as a prophylactic measure before operations upon the mouth and larynx in which much bleeding is anticipated, or as a means of providing an additional supply of air in cases of obstruction due either to mechanical causes or to inflammatory conditions, as well as for the removal of foreign bodies from the trachea. The indications for its performance are the same as for intubation, viz. urgent and progressive dyspnœa; but tracheotomy is usually done at a later period than intubation. It is employed for the relief of obstruction due to the presence of a foreign body, or from that caused by alterations in the shape and position of the trachea owing to goitre or other tumours of the neck. It is sometimes necessary to relieve by this means the obstruction caused by the pressure of a retro-pharyngeal or other cervical abscess, or it may be performed for active ulceration of the larynx due to syphilis or tubercle, as well as for new growths in the larynx.

It is of the utmost importance
be performed before the child i
great advances in recent surger
of the fact that early tracheotor
in suitable cases of dyspnœa, th
less to the treatment of diphth
obstruction to the entrance of
operation should be performed
diphtheria where intubation has
the abundant formation of mem
tracheal inflammation, and wh
involved. Pneumonia does not
performance of tracheotomy in
typhoidal condition owing to sep
contra-indicate the operation, or
greatly against its success.

The Operation. — The instr
operation in a child are Durha
able collars, Parker's angular
18, 22, and 28 being the most u
preliminary to an operation upon
burg's tube, which is provided v
capable of being blown up so as
the trachea, as is seen in fig. 3
dilator; two or three pairs of pre
aneurism needles or blunt hooks
a sharp hook; two moderate-siz
be very sharp; tapes, and a fe
feathers to clean out the trache
duced.

It is better to give chlorofo
already narcotised by the circulat
only enough should be administer
breathe quietly; and it is not nec

the skin incision has been made, unless the child begins to struggle or unless the introduction of the canula produces continued and convulsive coughing. No regard is paid in England to the position of the opening so long as it is in the middle line, but in Germany there is an increasing school of surgeons who advocate the opening of the trachea below the isthmus of the thyroid, and who in any case carefully avoid injuring the cricoid cartilage, as they believe that its division renders it difficult to keep the tube in a satisfactory position; a displacement of the tube due

FIG. 39.—Trendelenburg's tampon tracheotomy tube for blocking the trachea during operations upon the larynx.

to this cause, however, is more likely to occur in adults than in children. As soon as the child is unconscious, the neck is made as prominent as possible by removing the pillows from the head, and placing a narrow cushion under the shoulders, and a rolling pin or a wine bottle wrapped in a cloth answers this purpose very well.

The skin incision is made exactly in the middle line of the neck, its centre being opposite the point where the surgeon intends to open the trachea. It should only be

skin-deep, and should be too lon
as to prevent that escape of air i
times happens if the opening in
not correspond. When the con
of a leisurely operation, the di
carefully and cleanly divided, un
scratching and tearing the tissue
in cases of mixed infection, as it
and extensive suppuration. T
taken to keep strictly in the
reason retractors should be used
should be given into the charge
retracts each side. Some little
not to make too extensive a divi
fascia, nor to raise it too freely
Champneys has shown that air
so penetrate into the mediastin
emphysema, and that the air
the mediastinum and distend t
pneumothorax. It should be d
verse incision.

The isthmus of the thyroid
upwards or downwards, as the
divided.

As soon as the trachea is expos
passed beneath the cricoid cart
instant whilst its second and th
wards and exactly in the middl
often be sufficiently steadied by
the finger and thumb. In openi
of the knife must not be allow
wall, and a sufficiently large
into it to allow of the free es
inflammatory products. The di

the trachea along the side of the knife, its blades are separated, and the first ring of the trachea may be divided as the knife is withdrawn. The opening in the trachea is now dilated, and if the operation has been performed for the relief of diphtheria, as much membrane is allowed to escape as possible; a feather is then introduced and twisted round and round to clear the lumen of the trachea still further before the tube is put into place. An interval should always be allowed to elapse between the opening of the trachea and the introduction of the tube. The dyspnœa is sometimes so great that the leisurely operation here described cannot be performed, for the child may cease to breathe before the trachea can be opened. The dilator must be introduced in these cases as speedily as possible, and then artificial respiration must be diligently carried out by Howard's method.

The operator stands on the right side of the patient to pass the tube. He takes the dilator in his left hand, and the tracheotomy tube in his right, the upper part of the tube pointing to the right of the patient. He then introduces the lower end of the tube into the trachea, and by a slight *tour-de-maître* brings it into its proper position. It should be remembered, in selecting a tube, that the shorter and wider it is the more comfortable it will be to wear. It should be provided with a movable collar, and it is kept in position by tapes tied at the back of the neck.

After-Treatment.—The success of the operation depends greatly upon the after-treatment, consisting essentially in proper feeding and in causing the child to breathe warm air saturated with moisture. Pain and the obstruction caused by the tube often render deglutition painful and difficult. A good nurse, however, can generally coax the child to take enough nourishment to prevent the necessity of having recourse to artificial feeding. **Milk,**

either plain or peptonised, and with an egg beaten up in it, raw meat-juice or chicken-broth, with stimulants, are generally sufficient. Four to six ounces of food should be given every four hours, according to the age of the patient, and as much as three ounces of brandy may be given in the course of twenty-four hours. The quantity of food may be gradually increased, for the larger the quantity taken the less often will it be requisite to rouse the patient to give it. Twenty to forty ounces of milk a day is an average amount of food for an invalid child of four years old, and an endeavour should be made to get this amount assimilated, for those who take their food badly after tracheotomy are more likely to die than those who take it well. Dr. Habershon points out that vomiting, regurgitation, or dyspepsia after feeding, indicate that too much food has been given.

Feeding by the nose need not be adopted as a routine proceeding, but when it is necessary I have always followed the plan recommended by my friends Drs. Bullar and Habershon, of introducing a No. 4 or No. 6 soft rubber catheter. A small piece of glass tubing is fixed in the outer end of the tube, and the warm fluid food is placed in a glass syringe holding four to six ounces. The end of the brass syringe is connected with the glass tube by a piece of drainage-tube. There is usually no difficulty in passing the soft catheter into the œsophagus, and after the first feeding the child rarely resents its repetition. The manipulation is so easy that the patient may sometimes be fed without being awakened. Perchloride of iron and the tincture of nux vomica should also be administered in full doses.

The air which the child breathes may be warmed and saturated in several ways; many surgeons employ the "steam tent," arranged by fixing a lath to each corner of

the cot, connecting the uprights by crossbars, and covering the whole framework with a sheet. A thermometer should be hung inside the tent, on a level with the head of the patient, and the air may be kept saturated by means of a bronchitis kettle. The temperature of the room should be maintained as nearly as possible at 70° F. Many surgeons dispense with the steam tent, and content themselves with a thin and flat sponge, which should be of coarse texture. It is wrung out of a warm solution of boric acid, and is placed over the orifice of the tube. It must be frequently renewed during the first twenty-four hours after the operation, and it may then be replaced by a layer of moistened gauze.

When the operation has been done for diphtheria, the tongue should be depressed with a spatula, and the pharynx should be repeatedly sprayed with a hand spray every three hours so long as there is membrane, and afterwards every six hours. The same operation may be repeated at the trachea rather more frequently, the spray being delivered a short distance from the mouth of the tube. Dr. Collier and Mr. Pitts recommend a spray of one per thousand corrosive sublimate (except for the trachea) in preference to the ordinary one of boric acid, which sometimes causes irritation of the mucous membrane. A one or two per cent. of peroxide of hydrogen is often useful, or a solution made by mixing ten grains of bicarbonate of soda with an equal quantity of biborate of soda in an ounce of water containing two drachms of glycerine. A drachm of the spray should be used on each occasion, the operation should take three or four minutes, and an interval of five seconds should be allowed at the end of every half-minute. Dr. Collier also recommends that the nose should be douched with a warm boric acid solution, though either of the others may be employed, every three hours, and that it

should be sprayed with the corros
douching.

Constant and assiduous attenti
tube. It must be cleaned from
a feather along it with a rotat
nurse must be taught how to catc
mucus as it is coughed up, so th
stantly feathering. When a dou
as is now the rule, the inner port
and thoroughly cleansed every tw
membrane is being ejected; but the
ary conditions, only requires tak
days, though if there is very muc
changed daily.

The only dressing required for
simple ointment on a piece of lin
takes place rapidly, and with ve
wound sometimes, however, become
ritic or suppurative inflammation
become swollen from acute inflam
tissue and lymphatic glands. The
to the gravity of the prognosis, but
of fatal import. The suppurating
dressings of peroxide of hydrogen
tions of iodoform. Iced compress
the diffuse inflammation; but it
make free incisions into the swol
knife through the deep cervical fa
perform the operation with the lea

Dangers of the Operation.—
from danger either to the surgeon
many deaths are annually record
tracted during the performance of
amongst the younger members of

reduced in strength by the labours and anxieties of their first responsible public appointments. No operator, therefore, ought to render himself liable to direct inoculation by sucking the wound; and if there is reason to think that he has become accidentally infected, he should at once take antiseptic precautions by washing out his mouth and gargling with a 1 in 40 solution of carbolic acid. If the patient does not die on the table, the operation having been too long postponed, he may succumb within five days of the operation, either to broncho-pneumonia or to the effects of the disease for which the operation was performed. Hæmorrhage at the time of operation is sometimes troublesome, and it must be treated by seizing the bleeding points with pressure forceps. If blood gains access to the trachea, the two cut edges of the tube may be drawn upwards into the wound, and the trachea may be freed from blood in the ordinary manner.

Fatal hæmorrhage has taken place in a few very unusual cases some time after the performance of a tracheotomy, owing to a diphtheritic inflammation extending to the innominate or internal jugular veins, or from ulceration of the innominate or common carotid arteries, caused by the pressure of the lower end of the tube. Such accidents need hardly enter into the surgeon's calculations, but he should rather be on his guard to prevent the sudden death which more often takes place from syncope after tracheotomy has been performed for the relief of diphtheria.

Removal of Tube.—The tracheotomy tube should be removed as soon as possible. The surgeon may withdraw it four or five days after the operation if all goes well, and watch the child's breathing, with the tracheal dilator handy in case of accidents. The patient sometimes breathes well from the first, but it much more frequently happens that he has to be educated to laryngeal respiration, for the

muscles of the glottis no longer w
the diaphragm and the intercostal
taught to breathe systematically, fir
of the tube, and then by doing wit
shorter time. The difficulty is oft
fright: than physical, or due to a
power. The process of education
carried out by the person in whom t
dence. It takes on an average abou

Tracheal Sten

It happens in a certain proporti
tracheotomies that it is impossil
breathe without his tube. The dy
directly the tube is removed, or af
interval. Its onset is sometimes
difficulty in breathing may be m
patient is asleep. Many causes l
the obstruction may be due to a n
owing to cicatrisation of the cord
the arytenoids, followed by atr
muscles, and this is most likely to
tomy has been performed for th
causing injury to the glottis, such
lowing of foreign bodies. It is s
lomatous growths within the lary
to masses of granulation tissue, w
verted into fibrous tissue, forming
just above or just below the orific
said (p. 349) that these cases are mos
the cricoid cartilage has been divi
tion. Especial care, therefore, shou
this unnecessary injury, though f
the parts in a young child such d

infrequent. The granulations are in many cases undoubtedly due to the irritation of a badly fitting tube, which sets up ulceration of the mucous membrane, and may actually cause the production of valve-like prolongations of the mucous membrane. The obstruction in other cases follows extensive necrosis of the cartilaginous rings of the trachea, loss of elasticity in the rings, or even their displacement at the point of division.

Treatment.—When the inability to breathe without a tube is due to mechanical causes, and respiration is impossible even under an anæsthetic, immediate measures must be taken to ascertain the cause, and, if possible, to remedy the defect, as it is useless to wait in the hope that time will improve matters. Trélat has called attention to the fact that in stenosis of the larynx the phonation is first affected, whilst in stenosis of the trachea the dyspnœa is the earlier symptom. The existence of ulceration in the trachea is recognised by the blood-stained sputum, the cough, and the fœtid breath. In such cases the tube should be changed for one which fits the trachea better before the irritation has led to the formation of granulation tissue. The asymmetry and deformity of the trachea will give a clue to the cause of the obstruction when it is due to defects in the cartilaginous framework. There is no satisfactory treatment for these cases, though endeavours may be made to ameliorate the condition by the use of the triple dilating tube. The treatment of laryngeal obstruction is a little more favourable. Macewen's tracheal catheter may be employed in cases of slight obstruction, the instrument being introduced on a long probe through the mouth into the glottis, or upwards through the tracheal opening. It must be so arranged in either case that it extends below the wound in the trachea, and it must be kept in place until the tracheal opening is completely healed.

Operative interference is muc
in these cases. The wound in
thoroughly explored by enlarging
lation tissue and bands of fibro
dissected away, and an O'Dwyer
the glottis until the external wo
used in these cases is larger and l
intubation, and it may be left in
at a time; though if there is any
of granulations at the sides of th
recommends that the tube should
occasionally changing the shape
shoulder of the tube. Mr. Berna
who have had much experience i
very troublesome cases, recommend
thus left in position for long perio
have any string attached to it, a
caused. The tracheotomy wound
using the hard rubber plug devis
Brook, so long as the intubation is

All measures prove ineffectual i
and I know two or three children
selves reproaches to surgery by
tracheotomy tube in spite of all tha
So long as the tube is being wor
assure himself that the wound in
fretted by the tube, that no ulcerat
at the front or back wall of the
fault in the length or curvature
unduly strong solutions are not b
trachea.

INFLAMMATORY CONDITIONS O

Syphilitic and tuberculous inflam

occur occasionally, whilst extensive necrosis of the laryngeal cartilages is sometimes met with after typhoid fever. There are a few recorded cases in which an enlarged bronchial gland has gained admission to the trachea by a process of ulceration, and has caused sudden death by asphyxia.

SCALDS OF THE PHARYNX AND LARYNX.

Cause.—A scalded mouth and throat is quite a usual form of accident in children. It is caused either by their drinking out of the spout of a teapot or kettle containing very hot fluids, or, more rarely, by the actual inhalation of steam.

Morbid Anatomy.—The scalded mucous membrane soon becomes œdematous, and its surface may be covered by plastic deposits bearing a close resemblance to the patches of diphtheria. The œdema does not extend below the vocal cords, as there is an interruption to the submucous tissue at that point.

Symptoms.—The symptoms of a scalded throat vary with the amount of the œdema to which they are directly due. Dyspnœa is therefore the most prominent. A certain amount of shock attends all the more severe cases.

Diagnosis.—The inflammatory conditions have to be distinguished from the other causes of acute laryngeal inflammation, such as acute cellulitis, diphtheria, and retropharyngeal abscess. The scalding at the angles of the mouth and the peculiar œdematous condition of the injured tissues will serve to distinguish a scald from everything else.

Prognosis.—Scalds are always dangerous in young children, and a guarded prognosis must be given. Recovery usually takes place in the slighter forms.

Treatment.—The treatment is
and is directed towards the relief
to dyspnœa. The child should be
to breathe moist air; the shock
ordinary manner by warmth and
or three grain doses of ammonium
may be placed round the neck, and
carefully watched. The surgeon s
early, if the difficulty in breathing
Tracheotomy must be performed i
tion is impossible, and it is well
the dyspnœa has become so urgent

Sequelæ.—The sequelæ are
in children, but some amount of
produced.

NEW GROW

Chronic laryngeal obstruction i
new growths, usually papillomat
rarely cystic. They may be situat
or upon the ary-epiglottic folds,
are so numerous as to fill up the
pale pink in colour, pedunculated,
together as to form an uneven and

Symptoms.—They are either
child cries huskily from its birth
and cause more or less urgent dysp

Diagnosis.—The diagnosis in
made by laryngoscopic examinati
must be mainly symptomatic. Th
presence of papillomata must not
caused by laryngismus stridulus,
and it is not relieved by improving

the child or by removing those causes of reflex irritation to which spasmodic croup is usually attributed.

Treatment.—Single growths may be removed by the laryngeal forceps in infants and in older children, but nothing short of thyrotomy is of use when the growths are multiple and threaten to block up the glottis. A preliminary tracheotomy must be performed in these cases, and at the time of the major operation a small tampon canula, upon the principle (p. 348) introduced by Trendelenburg (fig. 39), should be used to prevent the access of blood to the bronchi. Mr. Bernard Pitts, in some recent lectures upon the "Surgery of the Air Passages in Children," however, says that if proper care be taken to arrest the bleeding in the ordinary manner, the use of such a tube is unnecessary. He employs the ordinary tracheotomy tube, keeping the trachea above it packed with small pieces of sponge, each on a string. The child is put into the ordinary position for tracheotomy, the thyroid cartilage is exposed, and the alæ are transfixed laterally by means of a needle threaded with aseptic silk. The cartilage is then divided in the middle line nearly up to the thyroid notch. The two alæ are separated, the silk thread is drawn out and divided, so that two retractors are provided. The glottis is thoroughly exposed, and the growths are then snipped away with a pair of scissors, cocain being applied from time to time to prevent spasmodic contractions during this manipulation. Mr. Pitts thinks that a fine Paquelin cautery passed over the points of section acts more satisfactorily than the chromic acid, which is usually used as a caustic in these cases. The silk threads are withdrawn, and the two alæ of the thyroid cartilage are sutured, the needle-holes in the two thyroid cartilages serving as valuable guides in obtaining exact approximation. The skin over it is brought together, and the tracheotomy tube

is left in position for a few d
heals kindly, but the operation
for a second crop of warty growt

FOREIGN BODIES IN TH

The presence of a foreign bo
always a matter of interest bot
the surgeon: to the physician c
of its exact localisation, and t
the difficulties connected with its

The foreign body is usually su
by a sudden and deep inspiratio
to the respiratory tract by the c
some small object in its mouth
children are usually parts of toys
other substances of a similar nat
are likely to have, and larger obj
find their way into the œsophag
is too small to receive them, and
fore much more frequent in the
than in their tracheas.

Symptoms. — The symptoms
position of the body. They are
those cases in which the foreign
but they are often so slight as
doubt whether so serious an acci
to the child. The cases attended
symptoms are usually the most
foreign body has then left the tr
bronchus, where it may become im
most probably set up a dangero
bronchial obstruction is complete
collapse of the lung.

The examination in all suspec

ducted with the greatest care and precision. When the body is lying in the trachea, there is no difficulty in recognising its presence; but if it has become impacted in a bronchus, the chil l must be stripped to ascertain whether the two sides of the chest are equally movable. Careful percussion may detect the presence of local impairment of resonance, marking the collapsed portion of the lung and so the approximate position of the occluding body. Auscultation will confirm the evidence gained from percussion by the absence of breathing sounds over the affected area and its exaggeration upon the opposite side of the chest when there is complete blocking of a large bronchus, or by superadded sounds if the bronchus be only partially obstructed. There may be no dyspnœa, but the respirations are often considerably quickened, and there may be a short cough when any muscular exertion is made. The temperature may remain subnormal, unless the foreign body is septic; but in several cases a sharp attack of fever has followed the removal of the body.

Prognosis.—The prognosis is so serious that an operation must be performed as soon as the presence of the body is found to be interfering with the respiratory functions, even in the absence of urgent symptoms, for spontaneous expulsion is of very rare occurrence. Mr. Goal,[38] however, records an interesting case in which a "hale of barley" passed from the trachea into the axilla, and was discharged by means of an abscess a fortnight later. Death usually takes place from œdema of the glottis, from ulceration of the larynx, from pneumonia, or from gangrene of the lung.

Treatment.—Tracheotomy offers the only means of treatment which is likely to be of any avail. A large opening should be made in the trachea, preferably below the isthmus of the thyroid; and Mr. Thos. Smith[38] suggests that the edges of the wound in the trachea shoul l be tempora-

rily attached to the skin whilst s
in the air passages below. It
open throughout the operation, a
the surgeon, and a source of saf
trachea should be held widely op
known to be lying in its lumen,
the first blast of air carries it ou
be impacted in one of the bronchi
by means of a probe, and an end
withdraw it by forceps. The gre
in these manipulations, or much i
lung.

The wound should be closed at
can be extracted; but if, unfortun
impossible, the wound must be lef
ing spring retractor in the trach
tomy tube.

The following instructive case
precaution; the specimen is in the
lomew's Hospital. A little girl,
lowed a glass bead, which "went
bead could be heard, by means
up and down the trachea betwee
larynx at each inspiration, and it
a tracheotomy. Just before the o
it was found that the movemen
longer be heard; and as it was
into the pharynx, and to have be
tion was postponed. Two days la
were audible in the right lung, a
displaced to the right, showing th
had become collapsed. Tracheoto
although the child was inverted
held open, and feathers were passe

bead could not be dislodged; a tracheotomy tube was inserted, and the child was put to bed. She had a violent attack of dyspnœa during the night, the tube was withdrawn, and the bead was immediately coughed up. She made a good recovery. The after-treatment in these cases is the same as after the ordinary tracheotomy operation (p. 351).

HERNIA OF THE PLEURA INTO THE NECK.

A few examples of this rare condition have been recorded. It seems to be most frequently caused by the rupture of a bronchus in the upper lobe of a lung which strips the pleura from the lung. In a case seen by Dr. Fowler, a child of three months old, who had recently suffered from a severe attack of bronchitis, presented a swelling upon the side of the neck, which became larger when the child cried or coughed, but which almost disappeared at each inspiration. In this case the rupture had occurred in both lungs, but the tumour was larger upon the left side.

HERNIA OF THE LUNG.

A portion of the lung is occasionally protruded through some part of the chest-wall as a sequel of an injury to the thorax. It forms a smooth tumour, which is resonant on percussion and can be reduced by pressure.

Treatment.—The treatment consists in the application of a pad and bandage over the affected part. If the swelling increases in size, it may be removed, for wounds of the lung heal very readily and completely in children.

EMPYEMA.[39]

Ætiology.—Empyema is a condition often met with in children after an attack of pneumonia; less frequently it occurs as a primary disease, acute in its onset. It is rarely

tuberculous or traumatic in origin. It is said to be most frequently associated with the presence of pneumococci, though other forms of micro-organisms, including the bacillus coli, are very common; cases, however, often occur in which no specific organism can be detected.

Symptoms.—The less common primary form begins with a convulsion or with vomiting. In all acute diseases, however, convulsions are very much more common in infants than rigors, so that the diagnostic value of a convulsion is not great. The temperature rises rapidly to 104°–105 F. The respirations are short, quick, and of the abdominal type. The pulse may be 140 or more in a minute. Cough, which is absent in the earlier stages, afterwards becomes dry and hacking. The dyspnœa is often urgent, and the child is with difficulty kept in bed. The duration of the acute attack is generally from seven to ten days, after which the temperature falls, but does not become normal. An empyema may be suspected when the child remains weak and continues to lose flesh, the cough persisting, and convalescence being retarded. The form is often due to a pure cultivation of the pneumococcus, and it can be cured sometimes by a single aspiration of the pleural cavity.

The subacute form, secondary to pleurisy with effusion, pneumonia, typhoid fever, and more rarely to tuberculous phthisis, is often so insidious in its onset that the presence of pus, even in considerable quantities, may be completely overlooked. The long continuance of pulmonary symptoms, with a persistent rise of temperature, and the occurrence of dyspnœa, rigors, sweats and localised pain in a child who has recently recovered from one of these diseases, always raises a suspicion that pus exists in the thoracic cavity, and affords an indication for an exploratory puncture. It is due to a mixed cultivation containing pyogenic organisms.

Dr. Dickinson has recently called attention to the comparative readiness with which the pleura suppurates in early life, so that what in a grown person would be a dry pleurisy or a serous effusion gives rise to an empyema in a child.

The physical examination of the chest in a case of empyema will show that one side is motionless, and will reveal the existence of extensive dulness, a condition which is rare in the pneumonia of children. The dulness, however, is not always easy to elicit; but percussion gives a sense of woodlen resistance which is characteristic in children, for in them it is a rule to find resilient chest-walls. The apex-beat of the heart is sometimes found to be displaced; but this is less common in children than in the empyema of adults. The breathing sounds are absent, or distant bronchial breathing, which may closely resemble tubular breathing, may be heard. Dr. Brothers has pointed out that the absence of râles in a child who otherwise presents symptoms of chronic lung disease is also very suggestive of pleural effusion; and if râles are heard all over the chest, except at a single spot, it is probable that there is a localised empyema. Many physicians have laid stress upon the fact that bulging of the lower intercostal spaces is observed in cases of empyema; but although the sign is a valuable one, it is by no means pathognomonic of the affection. There is often more or less lateral curvature in cases of long-standing empyema, the concavity of the spinal curve being directed towards the affected side, whilst the angles of the ribs become flattened, those on the sound side becoming more acute. There is also some rotation of the bodies of the vertebræ, but it is usually less marked than in the ordinary cases of scoliosis.

Diagnosis.—The diagnosis is readily confirmed by puncturing the chest with an aspirating needle, and two

important facts will thereby be as
fluid be present at all; and sec
whether it is serous or purulen
abscess in the lung may sometim
ture, and it may then be mis
Several things have to be take
aspirating a chest. The operatic
be carried out with strict asepsi
be converted into a purulent one
must be therefore thoroughly clea
freshly boiled, and the skin sh
scalpel, so that no dirty epitheli
the pleural cavity.

Prognosis.—The rate of mort
to bear a direct relation to the
Brothers, in an interesting paper, s
children, in whom the disease alw
the rate of mortality is nearly 5
gradually diminishes, until after t
almost nil.

Treatment.—Aspiration shoul
sixth or seventh intercostal space
or behind in the seventh or eighth
tion of the anterior two thirds v
of the rib. When an empyema
usually points anteriorly about th
or sixth costo-chondral articulatic
be made in performing an explor
needle may be too short to pass
thickened pleura, or owing to its g
may fail to penetrate it, and thus
tained. The empyema may be lo
puncture may be insufficient.

(1) *Drainage.*—When pus is fou

it all off, for simple aspiration more frequently cures in childhood than in adult age. If more pus is formed, it is better to drain the cavity at once rather than to trust to repeated aspiration. Even in the most acute cases, however, pus is not found before the third day, and usually not until after the sixth day from the initial symptoms. The intercostal spaces in children are so narrow that a thorough drainage can only be effected by removing a piece of rib or grooving two ribs so as to allow of the introduction of a good-sized tube. Mr. Pantin, my house-surgeon at the Victoria Hospital, has kindly given me the following account of the routine treatment which he and his colleagues adopt in cases of empyema; and as the resident medical officers at a large children's hospital have more extensive opportunities of treating the disease than any one, I here append it.

"If the empyema be general, and the dyspnœa be not very urgent, the chest is opened in the line of the angle of the scapula behind; if localised, it is opened at its most dependent part. When the dyspnœa is urgent, aspiration may have to be performed at once, the more severe operation being temporarily postponed. An exploring needle is always put in just above or below the piece of rib it is proposed to excise. The ninth rib is generally chosen for removal in cases of general empyema, on the grounds recommended by Mr. Godlee. First, because it is just above the level at which the diaphragm becomes adherent to the ribs when it has been drawn up as much as possible; secondly, because it is the most dependent part when the patient is lying on his back; and thirdly, because it is the most advantageous place for draining the whole of the pleural cavity, including its lower and posterior part, which can alone be drained by this means. An incision is made over the rib, about 2 or 2½ inches in length, after

the skin has been thoroughly cl
deepened by cutting through the
serratus magnus till the periost
membrane is divided along the wl
and is then stripped off the rib
until the bone is bare in front an
are applied, and about an inch of
anterior cut being made first. T
rounded off with a burr or raspa
far is entirely extra-pleural. The
either by introducing a director, a
with dressing forceps, or, if the
gristly, by carefully cutting throu
afterwards using the finger as a
now turned over upon his back to
and any large masses of lymph
finger. The cavity is never wa
water or lotion, unless its contents

"A stout, short-flanged drainag
is inserted, so that the cavity may
out any pressure of the tube up
The tube, which is easily made
drainage-tube, is not sewn in, but
at each dressing. A pad of wet c
with boric lotion, is then applied,
bed. The dressing usually has
twelve hours, and after that dail
tubes are substituted, as the disch
in quantity, and eventually the tu

"New bone appears to be produ
one case, which died a few week
closed, the rib was found to be con

"We have on an average one ca
this manner, and the results are

The average stay of the children in the Hospital has been six weeks. When death occurs, it is due to nephritis, broncho-pneumonia, and general tuberculosis." There is often some lateral curvature of the spine in cases of cured empyema; this is best treated by gymnastics rather than by the application of any form of spinal support.

(2) *Operation for Radical Cure.*—When the sinuses refuse to close, adhesions are present, and the lung does not expand, it is often necessary to resect several ribs so as to enable the chest to collapse upon the affected side,

FIG. 40.—Short-flanged rubber tube for draining the pleural cavity in cases of empyema.

the constant purulent discharge is then arrested by allowing the parietal and visceral layers of the pleura to become approximated. The operation should not be undertaken lightly, for it leads to marked deformity; but, on the other hand, it should not be unduly postponed in the cases which need it, for the prolonged hectic may lead to the child's destruction by lardaceous disease. The fourth, fifth, and sixth ribs are usually selected for removal. The operation is similar to that already described (p. 369), except that longer pieces of bone are removed, and the incision is made

along the intercostal space and n
that two ribs may be removed thr
finger is introduced into the cav
much and so many of the ribs are
to enable it to become occluded
made is to remove too little bone i
too much, for the thoracic walls h
repair. It is therefore better to
and the thickened pleura, and t
without much bleeding, as the p
occluded the intercostal vessels.
be removed is regulated by the s
was the recognition of this fact
make that important advance in
which has just been described,
resection of the ribs for the c
generally known by his name.

Treatment of Double Em

treatment of double empyema has
of much careful thought by sur
this country. The conclusions ar
and Mr. Pearce Gould appear to r
the general feeling upon this p
Clinical Soc., vol. xxiv. p. 83):
of double empyema, instead of be
drainage, renders the need for
urgent on account of the greater
to respiration and circulation. (2
be practised as a preliminary pr
at any rate some contraction of
result from it and further adhes
(3) That it is better to allow a fe
the two operations; and (4) tha
reason impossible, the two empye

aspirated a few hours before the operation. By this means the shock produced by the sudden removal of pressure from the lungs is got over, and the simultaneous drainage of the two pleuræ is robbed of its chief danger. (5) That double empyema treated by free drainage may be followed in children by very complete recovery. The condition is a rare one, and no case has yet come under my notice; but when it does I shall have no hesitation in following the advice given by Dr. Coupland and Mr. Gould.

Pleurisy.

Cases of pleurisy with effusion rarely come under the care of the surgeon, since a single aspiration is often sufficient to cure those children who do not recover under the ordinary medical treatment of rest and counter-irritation of the chest-wall.

PURULENT PERICARDITIS.[40]

Ætiology.—Purulent collections in the pericardium are either primary or secondary to septic infective processes in the thorax or other parts of the body. The pneumococcus and Friedländer's pneumo-bacillus have been found in the pus.

Symptoms.—It occasionally happens, after an empyema has been evacuated, that the temperature, pulse and respirations remain abnormally high; the dyspnœa continues, and the child does not experience the amount of relief which usually follows the operation. A careful examination of the chest should be made in these cases, and it may then be found that there is some œdema of the neck, that the area of precordial dulness is enlarged, that there is an intense interscapular souffle, and there may be the physical signs pointing to a pleural effusion at the base of the left lung—signs which disappear when the child is examined in the genu-pectoral position. These pseudo-

pleuritic symptoms are due to atelectasis of the lower lobe of the left lung, caused by the pressure exercised upon it by the pericardial effusion; and they are better marked in the child than in the adult, because the child's chest is small and narrow, whilst its heart is relatively large. The disappearance of the signs when the genu-pectoral position is adopted, is caused by the pericardial fluid falling forwards, and so ceasing to exercise any pressure upon the lung. This symptom is of course valueless if the pericarditis be associated with broncho-pneumonia, pneumonia, or pleurisy.

Diagnosis.—The presence of a purulent collection in the pericardium is very easily overlooked, so that if there is the least suspicion of its presence an exploratory puncture should be made with a trocar and canula which have been freshly boiled to render them aseptic. The side of the chest must be thoroughly cleansed, and the skin should be divided with a scalpel to prevent any chance epithelial scale being driven into the pericardium at the end of the trocar. The incision should be made in the fourth or fifth intercostal space on the left side and at a point about an inch from the sternum, to avoid injuring the internal mammary artery.

Treatment. — The puncture should be carefully enlarged if pus appears—for puncture is of no more permanent value here than it is in a case of empyema—the tissues being divided in an outward direction until it escapes freely. The wound must then be drained in the ordinary way, and antiseptic dressings applied. The cavity of the pericardium may subsequently be washed out daily with a 5 per cent. solution of boric acid at a temperature of 100° F. until the discharge ceases. Körte in one case resected the left fifth rib for the cure of a pericardial empyema.

CHAPTER XVIII

SURGICAL AFFECTIONS OF THE ABDOMEN AND ITS CONTENTS

TUBERCULOUS PERITONITIS.[41]

Ætiology. — Tuberculous peritonitis occurs very frequently in children, the direct source of infection most often being caseating mesenteric glands. The affection occurs at all ages, but is more frequent after weaning than in sucklings—a fact which, as Prof. McFadyean and Dr. Woodhead have acutely pointed out, raises a suspicion that the use of tuberculous milk may be a source of infection. Clinical experience has not yet demonstrated the correctness of this view; but there is no reason why we should not assume that it is correct, and boil all milk given to children. It is an easy precaution, for a single boiling is sufficient to destroy its infectivity; but if it be adopted, the infant should have a small teaspoonful of orange juice every day, as there is reason to suppose that some cases of scurvy are attributable to a too exclusive diet of such sterile foods.

Morbid Anatomy.—Tuberculous peritonitis occurs in several forms. There is the *acute miliary* type of the disease, for which little or nothing can be done in the way of operative treatment, and to which the child soon succumbs. It is marked by the frequency with which relapses take place. The *ascitic* type, in which the

exudation is serous, the result of the tubercle bacillus, or purulent, mixed one consisting partly of t partly of septic micro-organisms. to operative treatment, as was sh Spencer Wells in 1862, and del 1884. The *fibroplastic* type differ its extremely chronic course, and which adhesions are formed. It or less ascites, and is characterise which dense adhesions are forme *ulcerative* type, which is a very in children. The inflammatory p soften and ulcerate, so that on o shapeless mass of material is fo being glued together and to the ab matory exudation. It is not unus a fæcal fistula at the umbilicus. tuberculous peritonitis is unsuited

Symptoms.—The symptoms of what with the form, and though diagnose, the symptoms are some many laparotomies have been perfo intestinal obstruction only to find ity was full of pus. The classics the abdomen, with quick breathi tympanitic and tender belly, are s of acute miliary tuberculosis; usually more ill-defined. There i fever, better marked in the after in the morning. The bowels are occasional attacks of diarrhœa.

The abdomen in the ascitic for until it is rounded and shiny, with n

on its surface. It is resonant in front, and dull upon percussion in the flanks, the line of dulness altering with the position of the patient. The abdomen sometimes feels nodular, and in the cases of localised effusion the cysts are easily detected if, as usually happens, they are situated above the umbilicus. The disease in the fibrous form lasts months or years, and tends to undergo spontaneous recovery, though it may cause many sequelæ, due to the bands of adhesion. The patient in the other forms becomes anæmic and wasted; he is the subject of hectic fever and of lardaceous disease, unless he dies of the exhaustion produced by diarrhœa or from tuberculous meningitis.

Sequelæ.—The sequelæ of tuberculous peritonitis are recurrences due to persistence of the source of infection: fæcal fistulæ, the result of the inflammation spreading inwards through the bowel wall, or more rarely, outwards from tuberculous ulceration of the intestine. These fistulæ most often discharge themselves at the umbilicus, in the unopened abdomen; but if a laparotomy has been performed, they may appear at the scar. They sometimes close spontaneously, but they often cause death by setting up an acute septic peritonitis. Intestinal obstruction in its various forms is not an infrequent result of cured tuberculous peritonitis.

Diagnosis.—The differential diagnosis lies between tuberculous and other forms of peritonitis, as well as of the various conditions which render laparotomy necessary, and from some cases of typhoid fever. The exact nature of the abdominal lesion is always a matter of doubt, and it is this uncertainty which lends so great an interest to every case of abdominal section. Tuberculous peritonitis may be distinguished from the non-tuberculous forms by bacteriological examination, or by inoculation into guinea-pigs of the inflammatory contents of the peritoneum—a

method not permissible in this c
diagnosis is sometimes spontane
those cases where about a fortn
the operation, and when the wou
the scar becomes affected with t
I have several times seen such se
the ulcerated skin was freely re
there was no further recurrence.

Treatment.—The ordinary pa
first tried, but if these fail laparot
factory results in cases of tube
have been selected with moderate
operation well, and it appears to
the ascitic forms, and for the chro
with much exudation. In the lat
ing of the abdomen, and evacua
flushing the peritoneal cavity, give
asepsis must be preserved by t
the bowel may be disinfected int
tration of naphthol or naphthali
ministration of a drachm of castor
importance than in cases of septi
bacillus coli.

The incision in the ordinary asc
below the umbilicus, care being
bowel or omentum, for they are
peritoneum; not to injure the bla
higher than is expected; and not
by dissecting with undue care
subperitoneal fat and peritoneum.
cases are sometimes so greatly t
be mistaken for the omentum; and
by opening different layers of t
rapid healing of the wound. Th

cautiously pricked with a scalpel after it has been raised by forceps, and the incision should be enlarged with blunt-pointed scissors to the full extent of the wound, the fingers being used as directors to prevent injury to the bowel. All fluid should be evacuated, but the adhesions must be treated according to the individual case. The only general rule which can be laid down is that they must be treated as tenderly as possible, and no more should be done to them than is absolutely necessary. If the omentum is not adherent to the intestine, and is much infiltrated with tubercle, it may sometimes be removed with advantage; but it is often extremely difficult to stop the bleeding when this has been done, as the tissue is too soft to take a ligature.

The abdominal cavity may be flushed with sterilised water, a saturated solution of boric acid, a 3 per cent. solution of salicylic acid, or a 0·6 per cent. of common salt when the peritoneal fluid is purulent; if it be serous, it is better not to flush at all. The flushing must be done with the greatest care, and the stream should be full and gentle, rather than under high pressure, and delivered through a small nozzle. Its temperature should be 100-105° F. The wound must be closed at once in the simple forms, the edges of the peritoneum being brought together by a row of aseptic catgut sutures, whilst two or three sutures of silver wire are passed through the skin and muscular walls of the abdomen. Secondary sutures of horsehair are employed to complete the closure of the wound. The ordinary dressings are then applied, and primary union is the rule. The sutures in the skin should be removed about the seventh to the tenth day. It is important that the deep as well as the superficial parts of the wound should be brought into good apposition, for there is a tendency after these operations towards the formation of a ventral hernia, and, to still

further obviate this tendency, a
considerable length of time.

Drainage of the abdominal ca
to be avoided, as it leads to the
but it must be adopted when the
in the habit of putting a stout
abdominal cavity in purulent ca
operation, closing as much of the
of removing the tube as soon
diminished, usually in the cours
for the track of the tube is re
granulation tissue. The incisio
the swelling, in the encysted fo
contents are evacuated, and the
It appears that fistulæ are rath
localised than in the more diffu
peritonitis. It should be remem
of localised abscess the collectio
visible as soon as the abdomen is
cealed by the adhesion of two lo
careful search may be necessary t

After-Treatment.—The after-
much of the success of the operat
keeping the patient quiet, but not
bed, and in a room whose temper
65° F. Small doses of opium ma
day or two after the operation, if
the temperature rises, and enem
magnesia or half a grain of calom
The food should be given in a co
may often be peptonised with adva

Contra-Indications of Oper
contra-indicated in cases where th
instead of being distended; where

acute miliary type, and where rapid caseation or ulceration is taking place; where the peritonitis is only one manifestation of a general tuberculosis, and where it is associated with advanced pulmonary disease. Albuminuria due to tuberculous nephritis, and tuberculous inflammation of the bowels marked by melæna and diarrhœa, although they do not absolutely forbid the operation, are such serious complications that I do not myself perform laparotomy in these cases, unless there is some urgent necessity for so doing. I do not hesitate, on the other hand, to open the abdomen in the fibrous form of tuberculous peritonitis in which there is only slight effusion; in those cases in which the convalescence is protracted, and the patient is daily losing flesh; where the pain is sufficent to prevent him following his usual avocations; or where he has insuperable constipation apparently depending upon the presence of a constricting band low down in the abdominal cavity.

We are ignorant of the mode in which laparotomy cures these cases of tuberculous peritonitis, though there is no doubt that it does so, sometimes permanently, but sometimes only in part, for relapses occur, due to fresh infection. Cases of relapse, in which a second or even a third laparotomy has had to be performed, have shown how complete is the local cure; careful microscopical examination of the peritoneal nodules from these cases has shown that they have become more or less completely converted into fibrous tissue, so that there is reason to suppose that the cure is brought about by a process of phagocytosis, or by some other method leading to complete destruction of the tubercle-bacillus. The French surgeons have recently vaunted the successful results obtained by introducing camphorated naphthol (p. 8) into the peritoneal cavity in cases of the dry and of the ascitic form of tuberculous peritonitis. The fluid is drawn off with a

trocar and canula, and two to f
ated naphthol, are then introdu
drawn, and a collodion dressing i
at its point of entrance.

The following case of peritoniti
tainly of infective origin, and I be
It well illustrates the value of la
P. B., aged 14 years, was admitte
pital for Children. He had been
for the fortnight preceding his
plained of a cough and of night sw
been swelling for a week, and he
found him to be an anæmic, emaciat
distended belly, the skin being str
navel was flattened, and for an i
a bright red blush, as though a
There was a similar patch of redn
umbilicus and the ensiform cartila
matous, and appeared to communic
The abdominal walls were so rigid
felt through them. The flanks w
tinct thrill could be transmitted
abdomen to the other. The lungs
and the urine was free from albu
was 105° F., the pulse being 120.
admission I made an incision in
abdomen, half-way between the um
cartilage. Two pints of a dark yel
from the peritoneal cavity. The
taneously into a thick and jelly-
minutes after its removal. The
was dressed with cyanide gauze.

The patient bore the operation w
began to fall steadily and contin

normal. Fourteen days later he was sent to the convalescent home at Broadstairs; and whilst he was there, he complained of a pain in his right side and of troublesome cough. On the following day neither breath sounds nor vocal resonance could be detected upon one side, and the chest was absolutely dull. Paracentesis was therefore performed, and two pints of clear fluid containing some flakes of lymph were withdrawn. The operation was repeated nine days later, and a pint of effusion was removed. It had to be repeated for the third time ten days afterwards, when the fluid was found to be slightly greenish in colour, but not at all purulent.

A year later the boy was working in an office from 9 to 4 daily, and appeared to be in excellent health.

The case is of interest in many respects. In the first place all the external appearances were misleading, for they pointed to a purulent effusion into the peritoneal cavity, when in reality the fluid was of an acute plastic type. The spontaneous coagulation of the fluid shortly after its removal from the body was in accord with all that we know of the behaviour of the secretions of acutely inflamed serous membranes. The withdrawal of a fluid with so great a tendency to clot must necessarily have been productive of benefit to the patient by freeing him from much of the material likely to produce bands of adhesion with their attendant evil effects, and to this I attribute in great measure his perfect recovery, and the absence of any subsequent abdominal symptoms.

PERITONITIS ASSOCIATED WITH PNEUMOCOCCI.[42]

Tuberculous peritonitis is likely to be mistaken for another insidious form of peritoneal inflammation associated with the presence of pneumococci.

Ætiology.—This form of sup
primarily, when it may co-exist
or pericarditis, or secondarily
monia.

Symptoms.—It runs a prol
racterised by great pain, much
vomiting. The bowels may re
the attack, and there is often a n

Diagnosis. — If the belly be
rating needle, a greenish pus of
and having a tendency to clot,
pus has a faint and characteristic

Treatment.—The only treatm
prospect of success in these case
and it will then be found that
circumscribed or diffuse. The
exudation renders the operation
testines are matted together by a
has been delayed for any length
must be especially careful not to
of inflammation, for we suppose
open the abdomen in these cases,
condition of inflammation in the
as it is in tuberculous peritonitis,
a general tuberculosis.

Peritonitis in the N

Peritonitis in the new-born
puerperal infection, and is broug
extension of septic inflammator
umbilical cord. It is due in a fe
of the bowel resulting from an i
more rarely, to rupture of the sig

been assumed by Zillner and Genersich to be due to direct pressure upon the bowel during parturition.

INFLAMMATION OF THE VERMIFORM APPENDIX AND APPENDICULAR PERITONITIS.

Inflammation of the vermiform appendix occurs in males, in 80 per cent. of the cases, and in 48 per cent. of these it is met with between the ages of 15 and 30 years. Dr. Deaver stated that 15 per cent. of the cases occur in children under the age of puberty. Tordeus records a fatal case of perforation of the vermiform appendix occurring in a child of six months, and Balzer met with a similar case in a child aged seven months.

Pathology. — There can be little doubt that many cases of suppurative inflammation of the vermiform appendix are associated with the presence of specific micro-organisms. Ekehorn has shown that some of the numerous varieties of the bacillus coli hold a foremost position in this respect, whilst Barbacci of Florence maintains that more slowly growing and less conspicuous forms of microbe may also cause perforative inflammation. The acuteness of the inflammation appears to vary with the virulence of the particular culture producing it. The micro-organisms in each case seem to act by gaining access to the lymphoid tissue in the submucous coat of the appendix through a lesion in the lining epithelium.

The simpler forms of inflammation are, perhaps, more mechanical in origin. They may be caused by disturbances in the vascular arrangements of the appendix, due in part to an irregular shape of the organ leading to the formation of curves or angles in its lumen, which in turn facilitate the retention of fæcal masses. The perforative, as well as the non-perforative forms, are some-

times associated with the presence of foreign bodies, but this is a much less frequent cause than has hitherto been supposed.

Ætiology.—The causes formerly assigned to inflammation of the vermiform appendix must now be considered as predisposing conditions or as after-effects. They were tuberculous and typhoid ulceration, foreign bodies, and scybalous masses. The scybala so often found in inflamed vermiform appendices are doubtless produced by the glueing together of the fæces by the increased secretion from the mucous glands of the appendix, the increased secretion being one of the earlier results of the inflammation.

Varieties, and Morbid Anatomy.—Inflammation of the vermiform appendix is either simple, perforative, or relapsing, and each form may run an acute, sub-acute, or chronic course. The appendix varies greatly in shape, length, and position. In its simplest form it is a narrow tube of uniform calibre, lying in the long axis of the colon. Its direction, however, is most frequently inwards; it may lie behind the cæcum, or it may even be situated in the true pelvis. The existence of too short a mesentery often leads to its puckering.

The inflammatory changes may commence in the mucous membrane and may rapidly involve the whole organ, or the entire thickness of the walls may be involved from the first, and in either case gangrene may result. The more severe forms of inflammation necessarily involve the surrounding tissues, and the anatomical arrangement of the peritoneum determines in each individual whether it terminates in a general peritonitis, in a local peritonitis, or in an abscess behind the peritoneum. Dr. Fowler of Brooklyn, to whom we owe so much of our knowledge of this form of disease, has noticed an abscess of the anterior

abdominal wall pointing at the umbilicus, in two cases of inflammation of the vermiform appendix occurring in children.

Symptoms.—The symptoms of acute appendicitis are so urgent that they rarely escape notice. The onset is sudden, and in a typical case is marked by very acute pain, which after a short time is attended by nausea and vomiting. The vomiting ceases as soon as the stomach has emptied itself, but it reappears in the later stages of the disease when perforation has occurred, if an abscess has been formed, or if there is much intestinal paresis. The pain after a time is paroxysmal, and is in a typical case localised to "McBurney's point," situated in a line drawn from the anterior superior spine of the ilium to the umbilicus, and an inch or an inch and a half away from the spine at the outer border of the rectus abdominis muscle. The pain soon becomes diffuse, radiating from the umbilicus and into the pelvis. Young children complain of "belly-ache" and lie curled up on one side, though adults nearly always assume a dorsal decubitus. In a few cases the pain is referred to the right testis or to the neck of the bladder because the appendix is sometimes in close relation with the right ureter, a point which should be carefully borne in mind whilst operating.

Constipation is usually a marked feature in the attack, and Dr. Ryerson Fowler believes that it has some value in prognosis, for when it occurs early it indicates intestinal paresis and indicates a more than usually severe case.

Too much reliance must not be placed upon the pulse, respiration, or thermometer in these cases, for the worst forms may run their course without any great rise of temperature, and without much alteration in the pulse rate.

Increased abdominal pain, with distension of the ab-

dominal walls and progressive pr
by a rise which is soon followe
ture, and by a quicker and weak
by the occurrence of diffuse sept
however, soon sets in, the vom
patient dies.

Diagnosis.—The condition is l
acute intestinal obstruction, for in
less acute forms, for hip disease.
diagnosis of biliary or renal colic
assisted in the earlier stages by fi
muscles are somewhat more tense
by the increased tenderness up
rectal examination, as well as by
of micturition. Rectal examinati
enables the surgeon to feel the
appendix. The temperature in
appendix rarely rises above 10
thirst, and vomiting soon follows
become fæcal until the approach o
There is often a free evacuation o
ginning and at the end of the atta
is the rule whilst the inflammati
tympanitis occurs in the later st
absence of the mucous discharge w
intussusception.

The surgeon is rarely called upo
of inflammation of the vermiform a
initial symptoms may be follow
ordinary signs of a diffuse infectiv
necessary for him to be well acqua
in all its forms. The signs of per
themselves after the first defæcati
taneous or produced by an enema.

that the acute pain in these cases marks the instant of perforation; but I think that this is unlikely. General peritonitis often seems to be delayed, or it may never occur, because the adhesions prevent the local inflammation becoming general. A perityphlitic or perinephric abscess is sometimes formed instead of a peritonitis, and the pus may then track up the back for a considerable distance. It must be let out through a free opening in the loin, and the abscess should be thoroughly washed and drained.

The inflammation in the appendix is sometimes recurrent, the patient appearing quite well in the intervals; but the frequency of the attacks, coupled with the anxiety incident upon them, may render him a chronic invalid.

Prognosis.—The prognosis in cases of simple inflammation of the appendix is good, for the vast majority of cases recover under medicinal treatment. The prognosis of perforative inflammation, when the general peritoneal cavity has become involved, is death speedy and painful unless laparotomy be performed.

Treatment. (1) *Therapeutic.*—The duration of the uncomplicated form is about a week, and it yields readily to opium, though, if one could be certain that the attack was due to the action of micro-organisms, causal treatment would be adopted. Such saline purgatives as Rochelle salts, administered with discrimination, or small doses of calomel with extract of belladonna or spirits of chloroform, are preferred by many surgeons to opium for the relief of pain in such cases, the object of the purge being to wash the micro-organisms out of the intestine. Mr. Treves has recently suggested that salol as a powder, and in ten-grain doses for an adult, should be employed as an intestinal antiseptic. Such means, however, must be used with the greatest care, and are only to be recom-

mended to those who have had gr
treatment of appendicular peritonitis
Glycerine of belladonna—a drach
be used as an external applicatio
dominal pain, in addition to the o
tions which are so soothing. The q
of great importance in the treatment
tonitis. Only such foods should be
digested by, and can be absorbed in,
alimentary canal. Eggs, peptonised
food are therefore the most suitable f

(2) *Operative.*—The question of
in cases of inflammation of the appe
debated by surgeons. All are agreed
tion is demanded when there is evi
whether the accompanying peritoniti
the relapsing cases alone being open
surgeons hold that in these cases
ference is admissible; others, with
reason, maintain that each case mu
its own merits, that when two or
taken place, when there is much d
tervals, and when the patient is un
daily duties of his life, an operatio
sible, but is actually indicated. Th
cases must be performed in the int
acute attacks, for the patient is then
able position for recovery, as no drai
is required, and union by first inten
pated with confidence. Recurrent
distinguished from chronic relapsing
current forms appear to be due to
brought into play by digestive distu
chronic relapsing condition is due to

local infective lesion. The recurrent form should be left alone; the chronic relapsing type demands operation when the interval between the attacks is short, and there is evidence of the persistence of suppuration.

When the abdomen does not contain purulent fluid, the patient may be placed in the position recommended by Trendelenburg (fig. 41), with the abdomen on a slightly higher level than the head and the feet, as it facili-

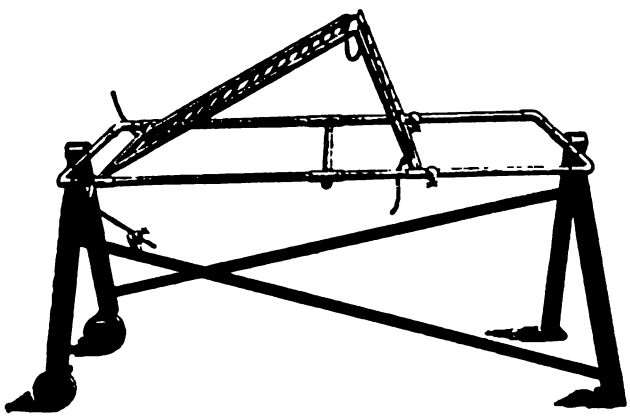

FIG. 41.—Fowler's modification of Trendelenburg's Operating Table, for use in abdominal explorations. It is capable of lateral rotation. The angle at which the table is set in the drawing is much too acute.

[Copied by permission from the "*Annals of Surgery*," vol. xix, 1894.]

tates an examination of the abdominal cavity. Dr. McBurney then makes an oblique incision in the skin, about 4 inches long in an adult, and nearly at right angles to a line drawn from the anterior superior spine of the ilium to the umbilicus. The incision is carried about 1 inch from the iliac spine, and is so situated that its upper third lies above a line carried from the anterior superior spine of the ilium to the umbilicus, whilst it terminates just opposite the deep epigastric

artery. The aponeurosis of the ex
divided, and then the internal o
versalis, but not to the full exten
and more towards the inner than t
fibres of the muscles and aponeur
are not cut across, as there is the
formation of a hernia.

An incision is made through the
if an abscess can be localised, thou
peritonitis the position of the swelli
line of the incision; for if it proje
abdomen must be opened parallel wi
whilst if the swelling is well to
anterior superior spine of the ilium
carried immediately to the inner si
lunaris, so as to divide the rectus m
fascia, for the muscle heals better, a
of a ventral hernia than when the l
is cut through.

Great care must be taken as soon
reached, lest the appendix or cæcu
tently injured. The general perito
cut off at once from the area of t
peritonitis is found to be localised.
by protecting the parts with gauz
sterilised without the addition of a
The vermiform appendix is exposed
amined; if it is distended, discolour
it may be removed by clamping it
passing an aseptic silk ligature rou
inch away from the gut, and cuttin
below the ligature. A cuff-shaped fl
exceptionally favourable cases, or
is performed for relapsing inflamma

described by Dr. Fowler (*Annals of Surgery*, xix., 1894, p. 348), the mucous membrane exposed in the wound being destroyed by a single application of fuming nitric acid.

A similar method of treatment may be adopted when a localised abscess of some days or weeks' duration has ruptured, and if the general peritoneal cavity has become involved in the inflammatory process. The abdomen should be then thoroughly flushed with a 2 per cent. solution of peroxide of hydrogen. The abscess must be opened and drained when adhesions have been formed between the vermiform appendix and the abdominal wall; but care should be taken not to break down the adhesions separating the abscess from the peritoneal cavity. The appendix in such cases should neither be looked for nor removed. The abscess should be emptied if symptoms of obstruction be present, its cavity should be disinfected; and if the obstructing adhesions can be identified, they, and they only, should be divided; but if they cannot be identified, all the adhesions must be separated, and the vermiform appendix must be removed.

The surgeon must decide for himself in each case what must be done to the peritoneal cavity. Thorough but gentle sponging is sufficient when the peritonitis is local; but if it be general, it should be well flushed with a 0·6 per cent. solution of common salt at the temperature of the body. The abdominal wound is eventually sewn up, after a double drainage-tube has been inserted. When from any cause the vermiform appendix cannot be found, or it is deemed inexpedient to break down local adhesions, lest the inflammation should become generalised, it is usual to drain the wound by introducing into its depths a strip or two of sterile gauze, which must be renewed at each dressing.

After-Treatment.—The after-treatment consists in

feeding with nutrient enemata o
three days, and then gradually incr
solidity of the food; when the bowel
one-tenth of a grain of calomel ma
until defecation takes place.

INTUSSUSCEPTI

Ætiology.—Intussusception occu
ages, though it is perhaps a little
the teething period than at other tim
acute or a chronic course. The predi
exciting causes are quite unknown, b
peripheral as well as local irritation

Morbid Anatomy.—Leichtenster
forms of intussusception as follows
ileum, or ileo-ileac invagination; the
or colon invagination; the ileum at the
involving it or the colon—ileo-cæcal i
the ileum into the colon without infol
valve, or the ileo-colic invagination.
nearly always descending; but a few
under the notice of the Pathological S
the true ascending variety which had
for the intussuscipiens was united to
by a plastic deposit.

Symptoms.—An acute intussuscep
child who is apparently in good healt
attack of abdominal pain, with repeate
passage of small quantities of blood
rectum. The pain is often very violen
tinuous, but is liable to paroxysmal in
panied by much straining, with scre
After a short time there is usually co

though in a few cases this is replaced by diarrhœa. The most characteristic sign of the disease is the formation of a definite tumour, which can be felt through the walls of the abdomen, and in some cases by a finger introduced into the rectum. The tumour is smooth, slightly movable, not very tender, and cylindrical. It is felt in a typical case above the umbilicus, and shades away towards the right flank, extending along the right linea semilunaris. The presence of the tumour may be masked by tympanites. Rectal examination, when the tumour has advanced into the left flank, as it soon does, will sometimes reveal it as a congested mass with a central aperture somewhat resembling the adult os uteri. This mass may be seen and felt to advance when the child strains.

Prognosis.—Recovery may take place spontaneously in slight cases, or by sloughing and adhesion of the two parts of the intestine in the more advanced forms. This termination is so rare, however, that expectant treatment must never be adopted, or even suggested in acute cases. Death from exhaustion or peritonitis usually takes place between the fourth and seventh days in cases of untreated intussusception, and the pain is so atrocious until gangrene of the intestine occurs, that no child should be left to die in this manner. In some cases, however, it runs a very slow course.

Diagnosis.—Intussusception has to be diagnosed from the other forms of acute intestinal obstruction which are common in children. No mistake is likely to be made if the cylindrical tumour can be felt in the left flank; but if it be not present, the differential diagnosis between intussusception, some forms of suppurative peritonitis, inflammation of the appendix, and the obstruction due to pressure from enlarged mesenteric glands, may be very difficult, and can only be made by performing an abdominal section.

A marked depression in the right
Danz), from the displacement of th
may give a clue to the diagnosis of
lapse usually occurs earlier, and is a
in intussusception than in other fo
obstruction in children.

Treatment.—The treatment is e
adopted for a strangulated hernia;
and kneading the abdomen taking th
laparotomy replaces herniotomy. I
may be considered as occupying that
of children which is filled by st
adults; for just as intussusception is
whilst strangulated hernia is rare, so
hernia is common and intussusceptio
arguments for treatment by operati
both cases. As in hernia no one wo
before he had applied taxis, so in i
would perform laparotomy before he
the bowel. Prejudice dies hard; an
of Percivall Pott there were many su
the medical treatment of hernia wa
in our own time there are some who
advisability of opening the abdom
susception; yet in children laparo
dangerous operation than is hernioto

The success of the treatment dep
and in intussusception, upon the ca
earliest possible stage; but in both
may be so acute, and may have run so
to render death inevitable. At St. Bar
in 1893, the abdomen was opened seve
ception: in five cases the intussuscept
these cases recovered. Three of the

one year of age. Two infants, aged six months and seven months, died after laparotomy and incision of the intussusception.

Inflation of the intestine should be tried directly the surgeon has diagnosed the presence of an intussusception, but arrangements should be made for proceeding at once to a laparotomy in case it fails. The child should be clothed in a jacket of absorbent wool, roughly tacked together for the occasion, and its legs and thighs should be protected by wool and bandages, for it is of great importance to keep him warm during the necessary manipulations. He is then placed upon a small water-bed, half-filled with water at a temperature of 110° F., over which is placed a single fold of blanket and a mackintosh sheet. He is anæsthetised, and an oiled and warmed catheter is gently introduced into the rectum, an assistant compressing the buttocks to keep the anus closed round it. The end of the catheter is connected with four feet of india-rubber tubing terminating in a funnel. The tubing, with a quart jug of 0·6 per cent. salt solution at a temperature of 100° F., is given into the charge of the second assistant. The child is then inverted and held by a nurse, whilst the assistant is directed to fill the tube with salt solution, and to raise the funnel from 2½ to 3 feet above the child's anus. If fluid enters the bowel, about a pint may be introduced, the surgeon at the same time gently kneading the abdomen with his finger-tips and the flat of his hand in the course of the colon from the sigmoid flexure towards the ileo-cæcal valve.

The success of the injection is marked by the disappearance of the tumour, by a gurgling beyond it, and by the distension of the intestine upon its cæcal side. When this happens, the child should be laid down, the tube removed, and in a short time he should be put quietly to bed, with as little movement as possible. He should be carefully

watched, however, for it often happens that the intussusception recurs, and the operation of inflation may have to be repeated.

Many other means of inflation have been employed—air, water, oil, milk, and hydrogen being the most usual. Some surgeons prefer to inflate with a Higginson's syringe. The operation is always attended by some danger of rupturing the bowel, and it must therefore be performed with the greatest gentleness. Eight to ten ounces of fluid, allowed to make its own way into the bowel from a height of three feet, is sufficient for a child of nine months old; the amount and the force may be increased with the age.

Inflation is useless when the intussusception is beyond the cæcum in the small intestine; it is equally useless when the intussusception projects beyond the anus, and Dr. Taylor thinks that it is an unsuitable form of treatment when a tumour cannot be felt, and the diagnosis depends entirely upon the symptoms. It is, of course, absolutely useless in the latest stages of the disease, when adhesions have taken place, and when there is a suspicion of peritonitis. As a general rule, it should only be adopted within three days from the onset of the symptoms.

Laparotomy should be performed as soon as the surgeon has assured himself that inflation is ineffectual; but he should bear in mind that the earlier the operation is performed, the better results will he obtain; that it is never to be performed as a last resource; and that if it can be done within twenty-four hours of the onset of the symptoms, the child will probably recover. It is even more necessary to perform laparotomy early in cases of intussusception than it is to perform herniotomy early in cases of strangulated hernia; for the intussusception is more acute, and the delicate tissues of the child bear the inflammation worse. The incision through the abdominal walls is to be made so as to

expose the tumour, either in the middle line, in the left or in the right linea semilunaris. The same precautions for keeping the patient warm must be adopted as during inflation (p. 397). The intussusception is reduced by gently pushing and squeezing the intussuscepted portion of the bowel out of the intussuscepting part, but never by directly pulling it out. It will generally be found that a very moderate amount of pressure is sufficient to effect reduction; but care should be taken to see that the reduction is complete, and if necessary the mesentery may be shortened. The abdomen is then closed with sutures passing through the whole thickness of its wall, including the peritoneum, and it is dressed in the ordinary manner.

Many methods have been adopted for the treatment of intussusceptions which have proved, after laparotomy, to be irreducible or gangrenous. These methods may be summed up as longitudinal incision of the bowel, suture of the intussusceptum and intussuscipiens, with removal of the intussuscepted part, resection and immediate suture, the formation of an artificial anus. No case of irreducible intussusception has come under my care, and such cases will doubtless become less frequent as the advantage of early operation becomes more widely known, though they will always occur in the chronic as well as in the most acute forms of the disease. Barker's operation appears most likely to yield satisfactory results. He sutures with chromic gut the intussuscepted portion of the bowel to the intussuscepting part at its point of entrance. He then lays the bowel open by a longitudinal incision, turns out the invaginated part and cuts it short off, sutures the incision in the intestine, and thus restores its lumen.

After-Treatment.—The child is put to bed and fed upon peptonised milk and beef-juice or essence. Opium may be given if there is evidence of local peritonitis at the time of

the operation, but it is not required as a matter of routine; and when it is given, it is better to feed the child by the rectum.

Chronic Intussusception.[15]

Chronic intussusception runs a very slow course, though it may begin with acute or sub-acute symptoms. The constant pain subsides, but there are daily attacks of paroxysmal pain recurring with more or less frequency. Vomiting may be absent, and there may be no obstruction of the bowels, so that the case may be treated as one of simple enteritis, and the true nature of the disease may only be clear when a portion of the ileum protrudes at the anus, though there is even then a chance that it may be mistaken for a case of simple prolapse. The condition of the bowel in these cases appears to be that of simple invagination rather than of inflammation, strangulation, or inflammatory adhesion of its layers. The circulation through the walls of the intestine, therefore, remains free, and this accounts for the benignant course taken by the disease.

Treatment.—The treatment, if the condition is recognised early, consists in inflation; but laparotomy has yielded good results even a fortnight or a month after the onset of the symptoms.

CHAPTER XIX

HERNIA AND ITS TREATMENT[46]

THE subject of hernia is of great importance in children, partly because it is so frequent, and partly because surgeons are now beginning to recognise that so much can be done to cure it. It is either umbilical or inguinal, but in each case there is an acquired as well as a congenital form. Strangulation is less common than in adults, and it happens that two cases of strangulated umbilical hernia have come under my care during the past year. Well-applied trusses and careful management effect a cure in a very large majority of cases; but there is always a residuum in which these means fail. For such cases operative treatment must be adopted, for it is practically free from danger, and, except in rare cases, is effectual in preventing a recurrence of the rupture.

LUMBAR HERNIA.

Lumbar hernia occasionally occurs in children as a protrusion of gut in the loin, due in some cases to congenital defects in the region of Petit's triangle, and in others to a weakening of the abdominal walls, caused by the formation of an abscess connected with perinephric or vertebral disease. The hernia is reducible, and contains colon. The treatment consists in the application of a truss in the congenital forms, or in suture of the muscular walls over the hernia in the secondary variety.

VAGINAL HERNIA.

A vaginal hernia sometimes occurs as a congenital defect. It projects at the vulva as an extension from the vesico-vaginal pouch of peritoneum. Mr. Holmes performed a radical cure of such a hernia by first reducing it, and then dissecting flaps of mucous membrane from either side of the vagina and suturing them over the site of the protrusion.

UMBILICAL HERNIA.

Umbilical hernia is either congenital, when it is an exomphalos or omphalocele, the child being born with some of its intestines still protruding into its umbilical cord. It is sometimes acquired, when it is merely a dilatation of the navel to a greater or less extent. Exomphalos is not really a hernia in the true sense of the term, for the ectopic intestines were never included in the abdomen. It is always a serious condition, and may be associated with other congenital defects, most frequently, it is said, with spina bifida; but I have never seen them together.

Signs.—The protrusion consists of a neck of skin continued into a translucent sac composed of the coverings of the umbilical cord. The outlines of the intestine can often be distinctly seen through the sac, as is represented in fig. 42.

Prognosis.—An attempt should always be made to reduce an umbilical hernia as soon as possible, though this may fail owing to the large amount of gut in the sac, and the small size and very resistant nature of the aperture in the umbilicus. An operation is absolutely necessary if the intestine cannot be reduced; for if it is not performed, an adhesive and possibly a suppurative peritonitis will be set up by an extension of the process by which the

umbilical cord is separated, the sac may slough, and the child will die of general peritonitis.

I saw a good instance of this a short time since, when a child, two days old, was brought to me with a well-marked exomphalos. The sac was black and stinking at the point where the cord had been tied. The child had a subnormal temperature, its bowels had been opened three times since its birth, it had passed urine, and its belly was only slightly swollen and tender. I laid the sac freely open, and in doing so found that its walls were very thick and

FIG. 82.—Congenital umbilical hernia—exomphalos.
[*From the "Transactions of the Pathological Society of London."*]

œdematous. It contained a large bundle of intestine matted together by tough yellow lymph. The lymph was carefully peeled away with the finger and thumb, and the mass was gradually unravelled until it was found to consist of the cæcum with the vermiform appendix and about three inches of the ileum. The intestine was congested, but it was not gangrenous, and it was intimately adherent to the boundaries of the umbilicus. The adhesions were broken down with a probe, the intestines were washed with very hot water, and an attempt was made to replace them. The cæcum, however, could not be returned until

the abdominal wall had been divid
away, and the ring and the abdom
with silver sutures and antiseptic
The child bore the operation well,
hours later. A number of this cla
ever, been successfully operated upo

A piece of intestine may protrud
linea alba, though the umbilicus fo
exit. The ordinary cases of ruptur
less importance than an omphaloc
times cylindrical or conical, and s
button-shaped. They give rise to
and their spontaneous cure is the rul

Treatment.—They are treated b
possible any cause leading the chil
cough and phimosis. The local t
sewing a penny into a couple of laye
is placed flat upon its back, the ru
the pad thus made is applied from
to convert the umbilical aperture in
is thereby prevented from extrudi
secured in place by two strips of
placed crosswise over it. A broad
then sewn round the abdomen, and t
are changed by the surgeon as often
care being taken on each occasion th
not protrude. It is to be noted that
umbilical hernia are highly objectiona
to project into the umbilical ring.
natural process of closure. A radical
sary in a few rare cases when, in spi
the rupture steadily increases in siz
not be opened during its performanc
removed.

INGUINAL HERNIA.

Everything connected with inguinal hernia in childhood is of the greatest interest to the surgeon, on account of the frequency with which he is consulted about the affection. It occurs in the children of the poor rather more often than in those of the well-to-do. In each class, however, it presents important features. Rupture in a pauper child precludes a livelihood from mechanical toil, often the only means of subsistence available to it.

FIG. 43.—Diagram of the lower part of the abdomen of a child, aged eight months. The external abdominal ring is immediately below the "fold of Venus." Its situation on the left side is indicated by a transverse line. (After Fehsel.)

Rupture often renders the son of wealthy parents morbidly self-conscious, prevents him from making the best use of his education at a public school, and eventually shuts him out of the public services for which by interest or merit he might be otherwise peculiarly well suited. A truss is often useless for a poor child who has no personal attendant to see that it is properly adjusted, that the skin does not become chafed, and that the pad is not worn over the unreduced rupture. In the rich a truss may become a source of danger by being worn so assiduously as to lead to the apparent and temporary

cure of a hernia, the gut often re
and perhaps at some critical momen

Predisposing Causes.—Abnor
abdominal wall and defective closur
the tunica vaginalis testis are the m
ing causes of hernia in children. Fe
children under a month old, and fou
four was the vaginal process com
sides.

Morbid Anatomy.—Dr. Félize

Fig. 44.—Diagram of the lower part of the ab
years. The external abdominal ring is situated
figure, but not so low as in the succeeding one. (

is seen in the annexed diagram
modified from his most valuable wo
in Children, that in young adults (
abdominal ring lies low in the abdo
three finger-breadths below the cre
as the "fold of Venus"; in infants
(fig. 43), the external ring lies on a
whilst, as they get older (fig. 44),
comes better developed, the position
approaches the point it occupies i

widening of the pelvis also causes the inguinal canal to increase in length, for at birth it hardly exists. These anatomical points are of great importance in considering inguinal hernia in children, and they can be readily verified by invaginating the scrotum, and feeling with the little finger for the abdominal ring. It will then be found that the rings themselves are proportionately larger in the child than in an adult, whilst the inguinal canal is so short that the internal abdominal ring in an infant is in close proximity to the external ring. These are all points

Fig. 45. – Diagram of the lower part of the abdomen of a boy, aged fourteen. The external abdominal ring nearly occupies the position which it does in the adult. (After Félizet.)

of normal anatomy in a child; if it be predisposed to rupture, certain additional defects may be obvious.

The pillars of the ring may be defective, and this also has been worked out with much care by Dr. Félizet, who finds that the pillars are more often defective in boys than in girls. He assumes that the normal fig. 46 pillars should be thick, solid, and so tense that they vibrate when they are touched by the finger, and contract the ring when the child cries, strains, or makes an effort. He has met with pillars of this kind in 21 per cent. of 85 cases

in which he has made a careful examination during the performance of the radical operation for the cure of inguinal hernia. The aponeurosis of the external oblique

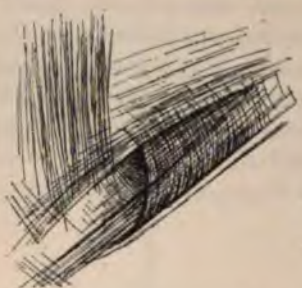

FIG. 46.—Diagram representing a normal external abdominal ring. Both pillars are well developed. (After Félizet.)

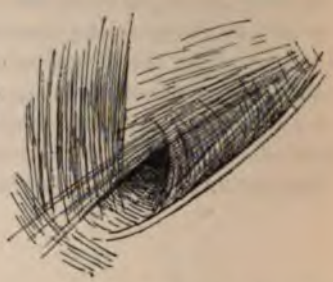

FIG. 47.—Diagram representing a defective external abdominal ring; the outer pillar is imperfectly developed. After Félizet.)

lying above the ring should be firm, well defined, not frayed out, and provided with a sufficient number of inter-

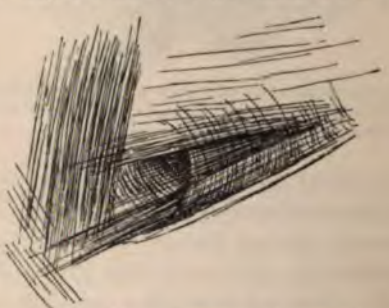

FIG. 48.—Diagram representing a defective external abdominal ring; the inner pillar is imperfectly developed. (After Félizet.)

columnar fibres running transversely across the canal. The departures from this type of ring are in two directions: the pillars are either weak and delicate, with a

sharp edge which is never taut; or, one or other pillar may be absent either completely or in part. Weak pillars occurred in 17 per cent. of Dr. Félizet's cases, and defective pillars in no less than 61 per cent. of his examinations in children affected with hernia. The weak pillars of the ring do not close upon the finger in the same active way as the normal ones do when the child strains, and they are often associated with a flabby condition of the aponeurosis of the external oblique, whilst the muscle itself is not well connected with the rectus of its own

FIG. 49.—Diagram representing a defective external abdominal ring; both pillars are imperfectly developed. (After Félizet.)

side, so that the whole of this part of the abdominal wall appears to be badly developed. The intercolumnar fascia, too, is frayed out and badly developed. Defective pillars are characterised by feeble development of the outer pillar, which is not uncommon (fig. 47); of the inner pillar of rarer occurrence (fig. 48); or of both pillars (fig. 49).

The tunica vaginalis in a child ought to be completely separated from the general peritoneal cavity by a more or less complete fibrous cord; but this separation, as Féré has shown, is often incomplete. In its slightest form the canal in the processus vaginalis may be almost completely

absent, except for a small funnel-sl
upper part; in its worst form the
retain the fœtal condition seen in fi
connection with the peritoneum b
The prolapsed intestine may pass i
vaginalis, and a congenital herni
which the gut lies immediately
in the same sac. The funicular
vaginalis may be shut off from the
whilst its upper part is continuou

FIG. 50.—Processus vaginalis about the end
uterine life. *Ep.*, Epididymis; *Gb.*, gubernacul
Test., testicle; *V.D.*, vas deferens.

[*Block kindly lent by Mr. C. B.*

the intestine passing into the unclo
a funicular hernia: these are the
hernia in children. The ordinary f
found in adults, in which there is a
as the encysted or infantile hernia,
but much more rarely.

The most important varieties o
children are those in which a scrotal
with an undescended testis; or it
by a hydrocele, or by a cystic enlarg

The exciting causes which convert a potential into an actual hernia are very numerous: coughing, straining, difficulties in micturition and defecation, associated with the weakness and relaxation of the tissues produced by the various exhausting and wasting diseases of childhood, are amongst the more frequent. The rupture is apparent in nearly half the cases within the first year after birth, and more than a quarter of the remainder appear between the twelfth and the thirtieth months, often as a result of measles, whooping cough, and chronic bronchitis; whilst the remainder appear later, either from similar causes, from a violent effort, or during convalescence from a severe illness in children with a family history of weakness in the abdominal wall.

Diagnosis.—The diagnosis of inguinal hernia is so obvious, and its signs are so well known, that it would be superfluous to dilate upon them. It should be remembered that, owing to the anatomical peculiarities in children (p. 405), the hernia is often situated much higher in the abdominal wall than is usual in adults; that it has somewhat less tendency to become scrotal, and, above all, that it has a troublesome habit of completely disappearing, so that the most careful manipulation fails to detect any sign of its presence. Such hernia usually reappear with as great facility as they have vanished, so that the surgeon should not be too positive as to the condition of a child reported to be ruptured, because he finds no trace of it, and because the abdominal rings and the canal appear to him to be normal, except for a slight degree of enlargement.

The presence of a small rupture may be masked by the co-existence of a hydrocele or of a displaced testicle. The hydrocele is smooth and tense, whilst the rupture is often soft and irregular, and in every case of suspected rupture

the surgeon should make a routi
testicles to assure himself of their
will thus escape many pitfalls.

Contents of Hernial Sac.—T
contains one or more loops of th
rarely omentum only is present. T
alone or in conjunction with the cæ
able frequency in the rupture; th
abdominal viscera are of much rar

Differential Diagnosis.—A h
guished from a hydrocele, either
from an abscess or a cyst occupyi
from enlarged and inflamed lym
retained testicle; and from the lob
sometimes surround the spermatic c

Prognosis.—The prognosis vari
and cause of the rupture. Some co
young children are undoubtedly cur
when no truss has been applied,
remain stationary or become large
treated. Spontaneous cure seems
cases of congenital and scrotal hern
have appeared in the later years
convalescence from one of the exh
are ignorant of the means by which
effected, though it is probably by
natural processes which ought to
before the birth of the child.

Sequelæ.—Irreducible herniæ a
ally in children, but they are much
persons of mature age. Acute st
means uncommon, and is attended
and symptoms of the condition.
certain peculiar features which are

adults. The bowel, even in acute strangulation, can nearly always be reduced by properly applied taxis; and in the very rare cases in which herniotomy has to be performed, the smallest possible incision of the point of constriction is sufficient to allow ready reduction; whilst it often happens that the prolapsed intestine can be replaced as soon as the ring is exposed, without any division of its deeper tissues.

Treatment.—The treatment of hernia in children is either by the use of a truss or by an operation. A certain proportion of children can be cured by the systematic and long-continued use of a truss; and this method should therefore be adopted in every case, unless it is clearly contra-indicated. It has, however, for too long a time been employed to the exclusion of the operation for radical cure. The operation for radical cure was practised by Sermesius, who says that he learnt it from a Russian feldherr, or apothecary, at the end of the seventeenth century. Freitage in Switzerland followed Sermesius' treatment, and Heister (*Surgery*, 1768, pt. ii., sect. 5, § 12) strongly recommends the method.

Palliative.—The trusses in common use in this country are the skein of white Berlin wool, which is useful for children so long as they wear diapers. It keeps the hernia up, is cheap, can be constantly changed, and does not cause excoriation. It probably has no curative action; but if it be conscientiously applied, it prevents the parts becoming over-dilated, by not allowing the bowel to be constantly passing in and out of the sac, and so allows of the completion of those developmental changes which should have been intra-uterine. Mr. William Coates, of Wrington, in Somerset, first called attention, on Sept. 4, 1848, to the use of the woollen truss in the hernia of infants, saying that he had learnt it from a gudewife in his neighbour-

hood. "It consists simply of a sl
infants, Berlin wool is preferabl
pelvis, one end being passed throu
corresponding with the inguinal
carried between the thighs, and is
portion which forms the cincture.
contrivance can be worn during th
ablutions, and then changed for a
is required on the part of the nurs
of changing. With ordinary care
the occasional application of magn
powders, I have never seen the ski

In older children a truss of rubb
frequently employed. It has th
washable; but its pad is not firm, a
excoriation. The ordinary spring
petent mechanician under the imm
the surgeon and adopted to the in
of service as a method of curative
usually be worn, however, until th
year old; it has to be constantly
grows. It is expensive, and, exce
tional conditions, it cannot be kep
child who has learnt to walk and pl

The most persistent use of a tru
only prevent the rupture from co
therefore only be palliative; but it
hernia if the rings are well formed
unduly dilatable, if the hernia is
is free, *i.e.* when it does not contain
cele, or a retained testis. A truss is
wasted in its application, in cases whe
when the pillars are badly develop
retained testis, and when the hernia i

exist, on the other hand, a class of doubtful cases in which a large abdominal ring readily admits the finger of the surgeon, and allows it to pass into the abdominal cavity without any sense of resistance being felt from the abdominal walls, when the pillars of the ring feel soft and membranous, and when they do not approach each other if the child cries or strains. A truss may fairly be tried in these doubtful cases before a radical operation is proposed.

A truss should be worn night and day for nearly a year, if it is decided to adopt this method of treatment. The child should be made to lie down daily flat upon its back for two or three hours, and it should be taken into the open air whenever the weather is suitable. It may be allowed to walk, but such exercise must not be carried to fatigue. Good food in its most digestible forms must be given, and the greatest care must be taken to keep the bowels in such a state as will lead to the least possible straining during the passage of a motion. Some hernia may be cured by these means, the pillars becoming firm and tense, and the funicular process closed; but it should not be assumed that because the rupture has disappeared it is necessarily cured, for it often happens that such apparent cures result in a reappearance of the hernia, sometimes at a critical moment, and such relapsed hernia are attended by all the dangers of an acute rupture.

The child may be considered permanently and not apparently cured when, after the rigorous use of a truss, the pillars are found to be approximated, when there is no sensation of impulse if the child coughs or strains, and if the patient passes through an attack of whooping cough without the rupture reappearing. The method by which a truss cures a rupture is as unknown as that by which a spontaneous cure is effected, and we assume that

it is the result of a slight irritatio
which leads to its gradual oblitera

Operative.—The radical operati
has been very frequently employe
years, but we still need more e
effect, as it is too soon to dogm
to any age, from the earliest infa
there are many surgeons who prefe
has reached four years of age be
I have no hesitation, however, in
bility in every case of congenital
methodical and sufficient applicatio
to effect a cure; when after such u
remains unduly large as compared
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The operation should in my opinio
cases in which the rings are badl
rupture is complicated with a ret
the sac appears to contain adh
radical operation, except in cases
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the relief is so great and immediat
so few, that I perform the operati
quently, and each time with a sense
tion. The good results are obtained
children; but the operation shou
in very feeble babies, during the
marked by intestinal disturbances,
tuberculous disease of the bones or
valescence from, or the prevalence o

The operation is performed earlie
the poor than of the rich, and in slig
because amongst the poor less pers
given to the children, and trusses a

skin, for they are apt in such neglected cases to be worn over an unreduced hernia.

The child is kept in bed for a few days to accustom it to restraint, and the operation is preceded by a thorough cleansing of the thighs and abdomen, and the application over-night of an antiseptic dressing. At the time of the operation the exact position of the external abdominal ring is determined by invaginating the scrotum, and an incision is made through the abdominal wall in such a manner as to expose it. The ordinary oblique incision may be used, and is necessary in cases of strangulation, and if the testis is retained in the canal; but for ordinary cases of uncomplicated hernia Dr. Félizet recommends that the incision should be transverse, as the branches of the superficial external pudic artery then escape division, and the wound is almost bloodless. The tissues are divided until the aponeurosis of the external oblique comes well into view, and this often lies at a considerable depth, for the front of the child's abdomen is covered with a very thick layer of fat. The aponeurosis is very dense, so that there is no likelihood of overlooking it, or of cutting through it inadvertently.

An assistant maintains a firm hold of the testicle in the scrotum as soon as the preliminary incision has been made, and the edges of the transverse incision are carefully retracted until the spermatic cord is seen. The cord is enclosed in a common fibrous sheath, which contains the hernial sac and the elements of the cord. The assistant, by pulling the testicle downwards, stretches the cord, whilst the surgeon divides the fibrous sheath longitudinally, and looks for the hernial sac. The sac is not always easy to find, for in children the knuckle of intestine is not often in it at the time of the operation, and it is so small and thin that it is readily overlooked by those unaccus-

tomed to see it. It usually lies t
front of the spermatic cord, althou
means constant, and its bluish w
guide to its presence.

The next step in the operation i
pair of pressure-forceps, and then t
which are materially assisted by
fibrous sheath and cremaster m
spermatic cord. The greatest car
be exercised in separating the sa
plexus of veins, the vas deferens, a
are so intimately connected with it
to be peeled off, and in doing this
danger of injuring them. The sep
the assistant keeps the cord tense
gently downwards in the scrotum,
less blended with the other constitu
upper than at its lower part, so th
the separation near the external
expects to find the vessels on the ou
the vas either in front or behind it.
children is extremely small, and in
as a capillary vaccine tube.

The sac is laid open as soon as it
same care being exercised and the sa
are usual in dividing the sheath of
turing it in its continuity. The ti
is then introduced into the sac, firs
the testicle, and then upwards into
mine the nature of the hernia and th
The entire hernial sac may be turne
in a few cases, but it happens much
the rupture is congenital and the sa
nalis itself. As soon as the middle

been isolated in a congenital hernia, a ligature of catgut is tied round it below the pressure-forceps, and the sac is cut across after the surgeon has satisfied himself that he is dealing with the sac, and sac only, and that he has not included the artery or the vas in his ligature. The lower end slips back into the scrotum to form the new tunica vaginalis testis. The upper part of the sac is then exposed by holding its cut end out of the wound by means of the pressure-forceps, and its neck is drawn downwards and ligatured with a simple loop of catgut tied with a reef knot in young children where the sac is very thin; in older children the neck of the sac is transfixed and tied with a pedicle ligature or with a Staffordshire knot, care again being taken that the neck of the sac only is tied, and that the neighbouring tissues are not included in the ligature. The sac is then cut away about half an inch below the ligature, and it disappears into the abdominal cavity, leaving the surgeon free to deal with the inguinal canal and its pillars.

The method of treating the sac is varied in older children, for in them it is stouter, and can be manipulated with greater ease. In these cases I usually adopt the method recommended by my friend Mr. C. B. Lockwood. The cut end of the sac is twisted and pulled downwards by means of the pressure-forceps attached to it. It is then transfixed by a Macewen's needle, provided with a handle like the ordinary "button-hook" (fig. 51), armed with a loop of aseptic silk. This ligature is tied tightly round the sac in a Staffordshire knot by throwing the loop over the pressure-forceps, and thus round the sac, bringing one end of the ligature above the loop and the other below it, and then tying the ends in a reef knot, so as to include the loop, and compress both halves of the transfixed sac. Each end of the ligature is then separately passed through

the eye of the Macewen's needle, w
traverse the fascia transversalis f
the arcuate fibres of the internal ob
muscles, and the aponeurosis of th
not the skin. The ends of the
through at two different points, s
tied together the stump of the sac i
beneath the arcuate fibres. If a tes
either be removed or sutured to the
as the surgeon considers proper (see

The operation is completed in ch
pillars of the ring so as only to allo
of the spermatic cord. Three sutu

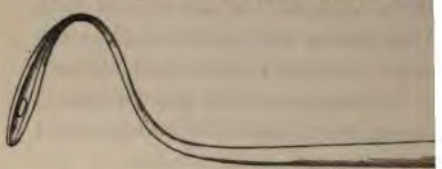


FIG. 51.—Macewen's Needle, employed in the
of hernia.

usually sufficient, the highest one b
care being taken to avoid including
whilst they are passed. The wound
with a 1 in 2000 solution of the p
iodide of mercury, and the skin is
with sutures of horsehair; and as i
union by first intention, no drainage-
dressing consists of a layer of antise
cyanide—with a thick pad of absorb
by a double spica bandage of gauz
red hat-lining sufficiently large to c
to extend as high as the navel, is laid
and the penis is drawn through a ho

protection is kept in place by a double spica of flannelette. The dressing should not be changed more often than is necessary, and a week may be allowed to elapse before it is touched. Although the wound heals well as a rule, yet it should be examined from time to time, because here, as in all other surgical diseases of children, neither sensations of pain nor the indications of the thermometer can be trusted in the same way as in adults to afford evidence of clinical value. Absence of pain by no means implies that everything is going well with the wound, for a very slight constitutional disturbance may cause a great rise of temperature, whilst a severe local inflammation may have no effect upon the general body heat. The skin wound is usually soundly healed in a week or ten days, but the child should be kept in bed for a month, and at the expiration of that time it may be allowed to go about. Examination of the scrotum will often show that it contains a swollen cylinder, which represents the indurated cord and tunica vaginalis; but this slowly disappears, and I have never seen any ill-effects from it. When the hernia is double, it is better to allow an interval of three weeks to elapse between the two operations.

CHAPTER XX

DISEASES AND MALFORMATIONS OF THE RECTUM

PROLAPSE OF THE RECTUM.[47]

Ætiology.—Prolapse of the rectum and anus takes place in children with great frequency. This appears to be due in part to the fact that the upper portion of the rectum is more movable than the lower; in part to the fact that the sacrum is nearly straight in children; and in part because they strain much more than adults in passing their motions. Dr. Jacobi thinks this straining can be explained anatomically by the presence of two or three angular flexures often seen in the lower part of the colon of a child. No prolapse occurs so long as the floor of the perineum remains firm and the sphincter contracts well. The prolapse in the earlier stages is slight, and only occurs during defecation; but it tends to increase in size and become permanent if precautionary measures be not adopted. The condition is often associated with general feebleness, chronic intestinal catarrh, thread-worms (oxyuris), phimosis, spasmodic cough, and more rarely with stone in the bladder, or with a rectal polypus. These causes should be first alleviated or removed.

Treatment.—Medical treatment in the vast majority of cases of prolapse will effect a cure, and I usually recommend that adopted by Mr. Allingham. The child is

to be kept in bed, and all its motions are to be passed lying upon its left side at the edge of the bed, the right buttock being drawn to one side by the nurse during the passage of the fæces, as the anal orifice is thereby tightened, and there is less chance of the bowel being protruded. The parts are then to be well washed with cold water, and if prolapse has occurred, they are afterwards to be sponged with an astringent solution of a drachm of alum in a pint of decoct. quercûs. The bowel should then be gently returned. Drachm doses of the compound liquorice powder may be given as a laxative if it is required. The injection of a minim of the injectio hypoderm. strychniæ nitratis or the $\frac{1}{100}$ of a grain of citrate of ergotinine into the rectal wall is also said to act beneficially in these cases by increasing the tonic contraction of the sphincter.

When the prolapse is not improved by these measures, more severe ones have to be adopted: and I usually dissect off a spiral strip of mucous membrane, taking care not to cut deeply into the submucous tissue, lest the hæmorrhage be severe. In a few cases I have painted the mucous membrane with strong nitric acid, afterwards brushing it over with olive oil; but this method is accompanied by so much pain and straining, that I prefer the former.

The bowel in either case must be thoroughly emptied before the operation, an anæsthetic must be given, and the anus should be well dilated. The mucous membrane must be dried before the nitric acid is applied, and care should be taken not to touch the skin or margins of the anus with the acid. After it has been applied, the surface of the bowel should be thoroughly oiled, and a pad of oiled lint should also be introduced into the rectum.

The operation of colopexy, or the cure of the prolapse by the formation of artificial adhesions, has recently been

suggested and practised for the w
fortunately, however, these do not
and I have had no opportunity of t
is performed through the same ab
inguinal colotomy. The rectum is
colon downwards; it is pulled stra
any tendency to prolapse, its musc
to the deeper parts of the wound,
closed. Verneuil's operation, mo
Marchant, consists in exposing t
beneath the coccyx and then sutu
operation is described with diagram
de la Soc. de Chirurgie, xvi. p. 828,

RECTAL ADENO

(1) SINGLE. **Morbid Anatomy.**
mata or polypi in children are usua
small and soft tumours, generally w
and nearly always pedunculated. T
thin that it may be ruptured whilst
at stool, and so the polypus may be sp
They are more often situated upon th
the anterior wall of the rectum, and
half to three inches of the anus. T
adenomata, consisting of Lieberküh
irregularly in a stroma of fibrous
fibrous, and dermoid (p. 515) polypi
curiosities.

Symptoms.—The symptoms are
bleeding may first give evidence of
bleeding is very slight at first, but a
more abundant, though it is only in
it is of any importance; it is often acc
discharge of mucus.

Diagnosis.—The diagnosis is readily made by a digital examination of the rectum, a mode of investigation which should never be omitted in cases of prolapse, fissure, and purulent discharge from the rectum, for these are the conditions most often associated with rectal polypi.

Treatment.—The treatment in the pedunculated forms is to twist them off; but if the pedicle be short or thick, it is better to place the child under an anæsthetic, and to ligature the polypus after the anus has been dilated.

(2) MULTIPLE.—Rectal polypi in rare cases are multiple and diffuse. Such multiple polypi occasionally occur in several members of the same family, and the irritation which they produce may give rise to an adenoid cancer whilst the patient is yet under twenty years of age. Cancer of the rectum occasionally occurs in young adults, independently of such growths. It is necessary to excise in these cases; but they are so unusual that I have never had occasion to resort to the operation.

BILHARZIA ADENOMATA.

Children in Egypt sometimes present multiple rectal adenomata due to the irritation produced by the ova of Bilharzia hæmatobia. These growths have been carefully examined by Dr. Mackie, of Alexandria, through whose kindness I have had opportunities of seeing several specimens.

Pathology.—The tumours are true fibro-adenomata and they are very vascular. Abundance of ova are found in the tissue, and the vessels running from the tumour contain fertilised eggs, ready for hatching in the blood stream in which the adult females are found.

Symptoms.—There is considerable rectal tenesmus, in addition to bleeding from the bowel, and diarrhœa.

Hæmaturia is a frequent symptom
urine is clear, Bilharzia ova may be
long survives the symptoms, and
istence until, worn out by pain an
it dies.

Diagnosis.—Digital examinatio
microscopical examination of the
establish the diagnosis.

Treatment.—The treatment is
lactic, for the lesions are so wid
genito-urinary tract that no local re
service.

NÆVI OF THE RE

Nævi occur in the rectum as pa
Mr. Marsh has reported one which
of ten. It gave rise to hæmorrhage

CONGENITAL IMPERFECT
RECTUM.

Varieties.—Cases of congenital
rectum are brought under the notice
sufficient frequency to put a seri
surgical resources. The chief variet
are: (1) Imperforate anus (atresia a
partially (atresia recti) or wholly d
et recti), the fold of the scrotum ext
an unbroken line to the coccyx. (2
into a cul-de-sac, the rectum being
being separated from the bowel by
which is either complete or is perfor
less extent at its centre. (3) Imper
male, the rectum being partially or

communicating with the prostatic portion of the urethra (atresia ani urethralis), or with the bladder (atresia ani vesicalis), at its base. (4) Imperforate anus in the female, the rectum being partially deficient and communicating with the posterior wall of the vagina just in front of the hymen (atresia ani vaginalis). (5) Imperforate anus, the rectum being partially deficient, and opening externally by a narrow outlet in an abnormal situation (atresia ani perinealis aut scrotalis). (6) The anus and rectum may be well formed and of normal size, but the outlet is obstructed by a fold of skin extending from the scrotum to the tip of the coccyx. A small opening may exist on one or both sides of this fold.

Cause.—The cause of the condition is well known to be due to a failure of the rectal invagination or proctodæum to effect a junction with the cloacal section of the alimentary canal. The condition in which the rectum terminates in the genito-urinary tract is the result of a further error in the developmental process, for in these cases the cloaca has not been completely divided into its urino-genital and intestinal portions.

Symptoms.—The symptoms both of the complete and of the incomplete forms are usually sufficiently obvious to attract attention within the first few days after birth. When the septum is perforated, however, it may be some weeks or months before the child is brought for advice. I have recently had a case of this kind under my care, which was satisfactorily treated by prolonged dilation with rectal bougies. The opening of the bowel into the urinary passages is productive of much trouble in boys, and may necessitate the performance of cystotomy: in girls, on the other hand, the opening of the rectum into the vagina is of much less serious import.

Treatment.—Cases of true imperforate anus, marked

by inability to pass a motion, distei
vomiting coming on about the third
all the energy and skill of the s
death of the child. Effective su
imperatively called for in these c
should remember that a similar gr
denote congenital strictures, or even
part of the intestines other than th
some cases a volvulus may produce
diagnosis may sometimes be made
stricture is beyond the reach of the
injection of warm water.

The relations of the peritoneum to
utmost importance in regard to the
be adopted for the relief of this co
majority of cases have died of perit
When the rectum is only partially def
is reflected from its anterior surf
posterior aspect of the bowel free t
the rectum is wholly wanting, the i
lower than the brim of the pelvis, M
the peritoneum completely invests
and must necessarily be wounded bef
reached from the perineum. This i
less importance to us than it was t
unable to keep their wounds aseptic
ever, is still sufficiently real to warra
the general rule, that in no case sh
made to puncture the bowel with a tr

When there is a well-formed anus
only separated by a thin septum, the
divided with a tenotomy knife, after
passed along the urethra, the child
and in the lithotomy position. If no c

an incision should be carried from the middle of the perineum to the tip of the coccyx; and if the middle line be strictly adhered to, there is comparatively little bleeding. The bulging bowel may be readily felt after a little careful dissection upwards, taking care to keep close to the hollow of the sacrum, and remembering that the bowel is usually situated within an inch or an inch and a half of the surface. If the bowel is found, it should be opened on its posterior aspect, the meconium washed away, and the opening plugged with gauze, the wound being allowed to granulate without the introduction of any sutures. The value of this operation, as Mr. Keetley has shown, is enhanced by the fact that the wound is easily managed, and that it is unnecessary to take the child away from its mother. If the bowel be not found, after a moderate amount of dissection, the child should be put to bed for twenty-four hours to recover from the shock, and inguinal colotomy should then be performed.

Inguinal colotomy in these cases is preferable to Amussat's or to Callisen's operation in the loin, first because there is more room to work in, and secondly because the bowel is opened nearer to its termination, and so there is less likelihood of failing to find it when, as often happens, the colon is displaced or presents other abnormalities. In addition to the ordinary arguments for the inguinal rather than for the lumbar operation, I have before me the fate of Mr. Baker's successful case. Colotomy had been performed in the left lumbar region immediately after birth; the case was successful, and is recorded in the *Trans. Clin. Soc.*, vol. xii. p. 240. The child died at the age of ten, having led a miserable existence. At the post-mortem examination the whole intestine was found to be greatly dilated, but below the colotomy wound it was distended into an enormous cul-de-sac, which, in the fresh condition,

held a quart of fæces. At the end
a small shrivelled portion, repres
tissue which intervened between t
intestine and the anus.

Mr. Cripps recommends that whe
cates with the posterior wall of th
should be performed until the child
It should then be anæsthetised, pla
position, and a strong bent probe sho
the fistulous opening, and made to
perineum in the natural site of th
munication between the vagina and r
probe can be cut down upon directly
quently happens, the end of the rectu
the vagina, a considerable amount of
quired before an anus can be formed.
taken in the after-treatment of these
wound closing. This is best done
of a rectal bougie of about the size
catheter. It is usually necessary t
nurse or mother that very serious da
the child by using this instrument at

It is even more important that an
performed in atresia ani urethralis
vaginalis, for Mr. Page records (*Th*
Journal, ii., 1888, p. 875) the case o
age of fifty-four, was leading a wret
this condition. A staff may be introdu
in these cases, and an accurate dissec
line towards the prostate should be m
is reached, the after-treatment being
previous variety.

FISTULA IN ANO.

Fistula in ano sometimes occurs in children, and is the result of an ischio-rectal abscess, often of a tuberculous nature, and more rarely of spinal caries in the lumbar region. Two Italian children, members of the same family, were successively under my care for the treatment of this affection. The sinus was laid open in each case, and the ordinary means of after-treatment used in adults were adopted with slow but satisfactory results. Ischio-rectal abscess in children is rather frequently associated with the presence of foreign bodies which have passed through the wall of the bowel. The abscess cavity should therefore be explored with a probe after it has been laid open.

FISSURE OF THE ANUS.

Fissure of the anus is occasionally met with in children It causes a sharp pain at the time the motion is passed, followed by a rhythmical and dull pain, lasting for some considerable time after defecation. A local application of some ointment containing cocain is serviceable in the slighter cases, supplemented with one-drachm doses of hazeline, pulv. glycyrrhizæ co., or confection of senna, to prevent the passage of hard fæces. The ointment I usually order consists of:—

℞ Hydrarg. subchlor., grs. iv.
Cocain. hydrochlor., grs. iv.
Ext. belladonnæ, grs. ii.
Ungt. sambuci, ounce i.
M. Ft. Ungt.
Sig. To be used frequently.

In the more severe cases, and when the ointment fails to relieve the pain, the child should be anæsthetised, and an incision made through the base of the ulcer in the manner usually followed in adults.

CHAPTER XXI

DISEASES AND INJURIES OF THE KIDNEY[49]

HYDRONEPHROSIS.

Symptoms.—Hydronephrosis, or distension of the kidney by urine, is either congenital or acquired. It is characterised by a tumour of definite shape, sometimes smooth and sometimes irregular in outline. The tumour is situated in the flank and does not usually extend beyond the middle line of the abdomen. It is a tense swelling, and a sense of fluctuation is usually attainable. It is dull on percussion, except where it is crossed by intestine. It is likely to be mistaken for an ovarian, mesenteric, or hydatid cyst.

Congenital Hydronephrosis.

Ætiology.—Congenital hydronephrosis is the result of local malformations or irregular origins of the ureters leading to kinks or constrictions in some part of their course, or it may result from similar alterations in the urethral passage. In a few cases it is the result of valvular prolongations of the mucous membrane of the ureters or of the urethra. I saw it in one case associated with an imperforate rectum, in which the sigmoid flexure, distended with fæces and abnormally situated, lay over the ureters in such a manner as to prevent the urine flowing freely along them. There are therefore several varieties of

congenital hydronephrosis, for it may be either unilateral, bilateral, permanent, or intermittent; the intermittent forms being those in which the urine only escapes along its ureter, when it has been pent up until the pressure is sufficient to enable it to overcome the obstruction. The permanent forms of hydronephrosis may show themselves at birth, or only after the lapse of many years.

Pathology.—The method by which hydronephrosis is produced has lately been the subject of a careful experimental study by Dr. Byron Robinson,[49] of Chicago. He shows that complete occlusion of the ureter produces atrophy of the kidney in a few months, whilst its partial occlusion produces a condition of hydronephrosis. The kidney will bear complete occlusion for some weeks, and will still resume its function as soon as the obstruction and the pressure are removed.

Treatment.—The treatment consists in aspirating or puncturing the tumour, and in cases of long standing a thick and brownish fluid is generally withdrawn. The needle is entered half-way between the last rib and the crest of the ilium, about three inches from the vertebral spine, and its point should be directed somewhat forwards. The tumour may be cut down upon and drained, if it refills; and if this fails to cure, or if its contents become septic, a nephrectomy should be performed. In skilled hands, and with due precautions, children bear the removal of a kidney excellently. Care must be taken, however, that the opposite kidney is healthy, and the abdominal incision is preferred by some surgeons to the ordinary lumbar operation.

Traumatic Hydronephrosis.

Aetiology.—Traumatic hydronephrosis is a convenient term, though it is not scientifically correct in the majority

of cases. Monod has shown that th
clude two distinct conditions: tru
which the pelvis of the kidney is dil
to the ureter leading to its rupture;
the ureter; or to a clot in the ure
rare, and the swelling only appears
In a few still rarer cases the inju
a movable kidney, and this may be
nephrosis. The second group is that
appears within a few weeks of the in
constitutional symptoms. The kid
normal in these cases, but the accid
separation of the perinephric tissue, a
its way drop by drop through a rent
the ureter, collects in the space thu
enlarges it into a tumour, whose wall
densed retro-peritoneal connective tiss

Symptoms.—The symptoms of
temporary hæmaturia following an inj
the kidney. There is a little tenderne
but there is a marked absence of shoc
ture may hardly be raised above the
appears to be quite well after a fe
abdominal muscles, however, soon beco
a fortnight to six weeks of the injury a
with a well-defined margin is disco
The tumour is usually painless, but it
attended with pain and restlessness.
swelling shows that it contains a cle
which is albumin and urea.

Treatment. — The tumour has
taneously in a few cases; in many it
after one or more tappings; whilst in
cured by free incision and drainage.

necessary to remove the kidney, though in cases of traumatic hydronephrosis it is better not to adopt this method until all others have been tried, for the kidney may remain healthy.

Dr. Aldibert has recently collected the various cases on record, and he finds that there are seventeen; of which one disappeared spontaneously; seven were treated by puncture, and of these six were cured and one died; nine were drained with or without a secondary nephrectomy, and of these two died and seven were cured. In cases of true traumatic hydronephrosis, it is well to ascertain the condition of the ureter before proceeding to extirpate the kidney, as an abdominal tumour in some respects simulating hydronephrosis is occasionally produced by dilatation of the ureters.

WOUNDS OF THE KIDNEY.

Wounds of the kidney are of much less frequent occurrence than ruptures. They are usually associated with intra-peritoneal hæmorrhage, and may require the removal of the kidney through an anterior incision.

RUPTURE OF THE KIDNEY.

Ætiology.—Rupture of the kidney is by no means an uncommon accident in children, owing to the frequency with which they are run over by vans in the streets of a large town; but the liver is more often lacerated than the kidney.

Symptoms.—Examination of a child whose kidney has been ruptured by direct violence will generally reveal a bruise or other mark of injury on the abdomen or flank, and there is a local tenderness. The urine may or may not contain blood, and there is usually much less shock than after injury to the other viscera. The bleeding is

often intra-peritoneal, due partly to has very little fat round its kidney the elasticity of the walls allowing t forwards until the peritoneum is rup ensues if the injury has been sev extensive.

Prognosis. — Repair very often slighter cases of injury, and the chil kept at rest in bed. Recovery takes the accuracy of the diagnosis might did not the pathologist know how con ing tissues become adherent to the kidney. In less favourable cases nephrosis, or perinephric abscess ma will require appropriate treatment.

Differential Diagnosis.—The dif ruptured kidney has to be made from the intestines, spleen, liver, and bla action of the bowels, the continuance slightly raised temperature, the com shock, repeated micturition, and th which does not contain blood in excess be signs pointing to rupture of the kid ful cases of abdominal injury.

Treatment.—Absolute rest in bed treatment of slight ruptures of the k severe forms all the symptoms of intr rhage will appear, and the sole chance life will lie in performing a laparotom kidney. Death will ensue in many c be done, or the surgeon may not feel undertaking it ; for he may find it in accurate diagnosis, so closely do the simulate those of hæmorrhage into the

RUPTURE OF THE URETERS.

The ureters are ruptured by direct violence. They are blocked and inflamed by the impaction of calculi. They are sometimes subject to tuberculous inflammation. They come, therefore, in various ways under the surgeon's cognisance.

Diagnosis.—The dilated and inflamed ureter can be felt, as an oblong tumour passing over the brim of the pelvis, by deep pressure at the point of intersection of a horizontal line joining the anterior superior spines of the ilium, and a vertical line passing through the pubic spine. The vesical portion can be felt in man by a rectal examination, and Guyon has called attention to the exquisite sensitiveness of this part of the ureter even when a calculus is impacted in the tube at a much higher point.

Symptoms.—The symptoms of impacted calculus are well known; those accompanying a ruptured ureter are much more obscure. Mr. Page records the case of a boy, aged five, who was run over by a light vehicle. There was no evidence of serious injury, so the patient was sent home. Two days later, however, his parents brought him to the hospital, having noticed blood in his urine. The child complained of pain in his right iliac fossa. He remained well until about twenty days after the accident, when his condition became worse, and it was resolved to operate. The abdomen was opened, and a large fluctuating swelling, about the size of a Jaffa orange, was discovered in the right loin. It was opened and emptied. The kidney was healthy, and it was not thought advisable to make a prolonged search for a possible rupture in the ureter. Four days after the operation the dressings were found to be saturated with fluid of a urinous colour. The temperature of the patient rose, and there were other evidences of septic

infection. A secondary nephrotomy formed. The child immediately be eventually made an excellent recover

Treatment.—This case exemplifi tending the treatment of accumulat injuries of the ureter. They are v septic if they are aspirated, and the expose them freely. This may be do or by a lateral incision through the a upper two-thirds of the ureter can be tinuation of the lumbar nephrotom twelfth rib carried obliquely downwa one inch anterior to the ilium, and th Poupart's ligament. The sac should drained. The opening of the ureter by incising the ureter below the sac, upwards into it. The valve on the inn should then be divided longitudinally be taken to prevent the recurrence of drawing the corners of the longitudin with a suture to transform the longitu verse incision, as is recommended by C his interesting article upon "The Surge in *The Annals of Surgery* for Septemb

PYONEPHROSIS AND PERINEP

Ætiology.—Pyonephrosis, or the c the kidney is dilated and contains pus, a of causes. It is very often connected w renal calculi. It occurs in tuberculous k be secondary to a hydronephrosis. The is also used loosely by some surgeons nephric abscess resulting from the punct

hydronephrosis, although, as has been said, such collections are produced by leakage into the tissues round the kidney or injured ureter, and never lead to distension of the kidney itself.

Symptoms.—The symptoms of pyonephrosis are usually similar to those of a hydronephrosis, except that the temperature of the patient may indicate by its daily oscillations the presence of pus. Here, as in the other suppurative diseases in children, the thermometer is not always a trustworthy guide, for there may be a large collection of pus and yet no increase in the temperature. Much pain radiating downwards may be felt from the tumour pressing upon the lumbar plexus, and the patient often keeps his thigh slightly bent, and leans towards the affected side as though his spine or hip were the seat of disease. Puncture of the tumour will alone make the diagnosis certain in these obscure cases.

Treatment.—The treatment of traumatic pyonephrosis consists in laying the abscess cavity freely open by an incision carried through the flank. The pus should be thoroughly washed away and the cavity explored. The kidney should be removed if it is found to be disorganised. If the pus has been formed in the connective tissue around the kidney, nephrectomy should not be performed, but the walls of the abscess should be scraped and its cavity should be well flushed and dried. The wound may then be closed without draining it, and an endeavour may be made to get union by first intention; but if the surgeon thinks that this is impossible, he should drain the cavity. Complete recovery often takes place, but in some cases a sinus remains. A secondary nephrectomy is sometimes required before this sinus will heal, and the operation is indicated when it discharges pus mingled with urine. The secondary operation, however, is much more difficult

than primary nephrectomy, for the k
surrounding parts consist of dense fi

TUBERCULOUS NEPI

Pathology.—Tuberculous inflamm
by no means rare in children. It
miliary tubercle affecting the pelvi
culous pyelo-nephritis in which the
a mass of caseating material, separat
fibrous framework of the organ. T
terested in cases of tuberculous pyon
to be primary in children, for even
have lasted for long periods of time
to discover other tuberculous lesion
infected urine has traversed the ure
many months, they are often found to
The renal disease may, on the other h
a general tuberculosis.

Symptoms.—The symptoms may
those produced by renal calculus.
turition, with pain on passing water,
troublesome sign, and it often persist
and general treatment. The urine
phates, and sometimes blood. It usua
There may be attacks of renal colic fr
local pain and tenderness in the loin.
of the flank with the patient lying u
may lead to the detection of a tumou
the kidney, whilst percussion shows t
dulness is considerably increased. T
temperature which may serve to distin
from a calculus formed in a healthy
not by any means a trustworthy guide

Diagnosis.—The tumour in the loin is liable to be mistaken for an enlarged spleen, or for an hepatic cyst, according as it lies upon the left or upon the right side. It may be distinguished from an enlargement of the spleen, by noticing that the spleen does not extend so far downwards into the iliac fossa as the kidney; by remembering that the spleen has a sharp edge which can usually be felt, and by percussing the abdomen; for the spleen has no colon in front of it, whilst a part, at any rate, of a renal tumour is resonant where the colon crosses it. Careful percussion on the right side will show that there is an interval between the upper border of a renal tumour and the lower border of the liver.

Prognosis.—The prognosis is always grave in cases of tuberculous pyelo-nephritis, for both kidneys are frequently diseased.

Treatment.—Nephrectomy is advisable when the surgeon can satisfy himself that only one kidney is affected, and the operation should be done at once through a lumbar incision. The tumour may be incised and drained, when there is doubt as to the condition of the opposite organ, leaving a nephrectomy to be performed at a later stage, if it is found to be desirable. Children bear extirpation of the kidney for inflammatory disease so well, that out of thirteen cases of primary nephrectomy for tuberculous nephritis collected by Aldibert,[49] nine patients were cured.

RENAL CALCULUS.

Stone in the kidney is not a frequent cause of trouble in children, though it is not of rare occurrence, partly because the kidneys of children appear to tolerate the presence even of large calculi, especially if they are embedded in the cortex, and partly because the majority of renal calculi in

children are very small, and are soon passed on into the bladder.

Symptoms.—The symptoms of renal calculus in children are practically the same as in adults. There is localised pain felt in the loin, and liable to exacerbations radiating to the penis and causing retraction of the testicle in boys, or felt at the umbilicus. The pain is increased by abrupt movements and is relieved by rest. It can often be elicited by percussing the loin sharply just beneath the tips of the last two ribs, the blow being directed upwards, forwards, and slightly inwards, when the patient is standing upright in front of the surgeon, who kneels before him. This direct evidence of the existence of a renal calculus is sometimes important, for the pain is occasionally referred to the kidney which does not contain the stone, whilst in other cases it is felt in the bladder. Such errors are more common in children than in adults, for children often have great difficulty in localising their sensations. The error in localisation is physiological rather than physical, however; for when the pain of a renal calculus is felt in the bladder, it is accompanied by painful micturition and a false incontinence of urine. Hæmaturia is a very constant symptom of renal calculus in children, and it is sometimes sufficient to lead to extreme anæmia—a condition which is readily explained by remembering how badly children bear losses of blood, and how long they are in recovering from a serious hæmorrhage.

The urine may remain clear and acid; it may be wholly devoid of sediment, even where the patient has repeated attacks of renal colic, but there is usually a little albumin. Microscopic examination of the urinary deposit in such cases will sometimes reveal the presence of numerous crystals of oxalate of lime, and will thus clear up the diagnosis of an obscure case. In many cases, however, the urine

contains pus, it is alkaline, there are abundance of phosphates, and it stinks.

Diagnosis.—It is often very difficult to distinguish such cases of pyonephrosis due to calculus from those caused by tubercle, except by the results of inoculation upon guinea-pigs, for the bacteriological evidence is not yet sufficiently reliable.

The differential diagnosis lies between tubercle and calculus, and between spinal disease and calculus. Severe attacks of renal colic, with the presence of much blood in the urine and a comparatively small amount of pus, would point to a stone in the kidney rather than to tuberculous disease. The absence of blood or pus in the urine, when repeated examinations have been made at sufficiently long intervals, would point rather to caries of the spine than to renal calculus, especially if the disease has lasted less than a year, and the symptoms have shown themselves in a tuberculous patient. On the other hand, if the trouble is of several years' duration, if the symptoms have been intermittent, and if there has been hæmaturia, there is presumptive evidence of a renal calculus. Careful manipulation by skilled hands will often detect very slight alterations in the shape, size, and condition of the kidney, especially if the patient be placed upon his sound side and be made to breathe deeply whilst his loin is being examined.

Treatment.—The treatment of renal calculus and of calculous pyelitis is still a matter of discussion, although all surgeons are agreed that operative interference is desirable when the pain is so great as to render the patient a chronic invalid. When the diagnosis has been made, it has to be determined whether one or both kidneys are affected, and then whether the affected organ is healthy so that the stone may be removed from it, or whether it is

so disorganised that it is necessary to remove kidney and stone together. When nephro-lithotomy has been decided upon, there still remains the last difficulty of finding the stone; for when the calculus is small and lies in the upper part of the cortex, I have seen the most experienced surgeons fail in their endeavours to find it. Lumbar nephro-lithotomy is usually sufficient; but when the kidney is very large, and when it is doubtful which organ is affected, or whether both contain calculi, an anterior abdominal incision gives the best results. A large suppurating kidney should first be drained through a lumbar incision, the calculi being removed if possible. It may afterwards be removed at the leisure of the surgeon and the desire of the patient.

MOVABLE AND FLOATING KIDNEYS.

Movable and floating kidneys occur in children, but much less frequently than in adults. Such kidneys may become diseased, but they do not appear to be more liable than kidneys anchored in the ordinary manner. Mr. Warrington Haward has reported a case in which a tuberculous movable kidney was excised. The patient was a girl, aged 16, who had suffered from increased frequency of micturition for sixteen months. The operation was performed through an anterior abdominal incision, and the patient died forty-four hours later.

RENAL TUMOURS.

Pathology.—The tumours of the kidney are innocent and malignant.

Innocent Tumours.

The innocent tumours are fibromata, adenomata, and cystic. They are sometimes intimately blended with the

kidney substance, and are sometimes isolated from it. They are much less common than the sarcomata, which form the large majority of renal tumours in children. The serous cysts found in connection with the innocent as well as the malignant tumours of the kidney are probably in all cases retention cysts, and have their origin in these remains of the Wolffian body which form the posterior part of the primitive mesonephros. Dermoids in their various forms are occasionally found.

Diagnosis.—The innocent tumours of the kidney are not, as a rule, capable of diagnosis unless they attain to a very large size. They give rise to few symptoms except slight hæmaturia, and they are not therefore of practical interest to the surgeon.

Malignant Tumours.[52]

Pathology.—Malignant tumours of the kidney in children are nearly always sarcomata, and they are generally atypical, for it is only in rare cases that they can be said to be of the round, spindle, or other variety of sarcoma. They must therefore very often be classed as teratomata, and amongst these the rhabdomyosarcomata or malignant tumours containing striped muscle fibres are by no means uncommon; whilst in other cases they may present a cystic and adenomatous type, apparently innocent, but often running a malignant course, for they may recur, and they sometimes disseminate. The cystic growth may form an integral portion of the kidney, but it is usually separated from the glandular substance by a more or less well-marked capsule. The cysts are lined with cubical epithelium.

Malignant tumours grow rapidly, and they are often so soft as to be mistaken for chronic abscesses, for they give the sense of fluctuation. The tumours have usually

attained to a considerable size before they cause pain or hæmaturia, and it is then too late to remove them, for they disseminate rapidly, and the lumbar glands are early affected.

Treatment.—Many nephrectomies have been performed by different surgeons in the hope of removing them; but 50 per cent. of the operations have proved fatal, and recurrence has taken place in nearly all the rest. The operation is performed through an anterior incision after the patient has been placed in Trendelenburg's position (p. 391), as this diminishes the venous hæmorrhage and improves the heart's action. The tumour should be shelled out of its capsule if possible, and its pedicle should be carefully ligatured. Dr. Robert Abbe[52] has recently reported two cases in which a sarcoma of the kidney was removed from a child, and in each case the patient was in good health a year afterwards. He took special care to prevent loss of blood at the time of the operation, and he kept the patient at an angle of 30° during, and for two days after, the nephrectomy. The child was kept very warm, and in addition to the ordinary means of preventing shock, enemata of two ounces of hot black coffee were administered.

Secondary sarcomata occur tolerably frequently in children, and an interesting variety once came under my observation in a boy of ten years old. He had multiple tumours of the orbits, internal ear, cerebrum, dura mater, kidneys, and other organs, which appeared to have been growing for about six months. They were sarcomatous in character and were of a bright green colour (p. 150).

CHAPTER XXII

DISEASES OF THE BLADDER

VESICAL CALCULI.[53]

STONE is so common in children that, taking all the cases of vesical calculi, it has been estimated that 50 per cent. of the patients affected are under the age of puberty. The calculi are usually single and renal in origin, though in exceptional cases they may be formed around pieces of dead bone which have gained access to the bladder along fistulæ connecting it with the acetabulum, or with the spine.

Symptoms.—The symptoms are usually more acute in children than in adults, for in children the bladder is very sensitive. The desire to pass water is frequent and urgent. The child is listless and does not play in the simpler cases, whilst in the more severe there is pain either at the beginning or at the end of the act. The pain may continue for ten or fifteen minutes after micturition. It is referred to the lower part of the abdomen and to the end of the penis. It is somewhat relieved by pulling upon the foreskin, so that the prepuce is often found to be elongated and either sore or thickened. It can sometimes be relieved when it occurs at the beginning of micturition by inverting the child: but the unhappy patient usually learns for himself, and adopts instinctively the position in which he can pass his water with the least discomfort. The pain is often very severe, for it gives a worn appearance to the child, somewhat similar to that

seen in cases of spinal caries. The
in small quantities at a time and
rupted, for the prostate is so rudim
may fall over the vesical orifice of
this reason that vesical calculi in
become impacted in the urethra. T
of hæmaturia, with or without mucu
upon the nature of the stone ; and a
tolerably common, bleeding is not of
inguinal hernia or a prolapse of th
result of the constant straining ass
sence of a stone in the bladder.

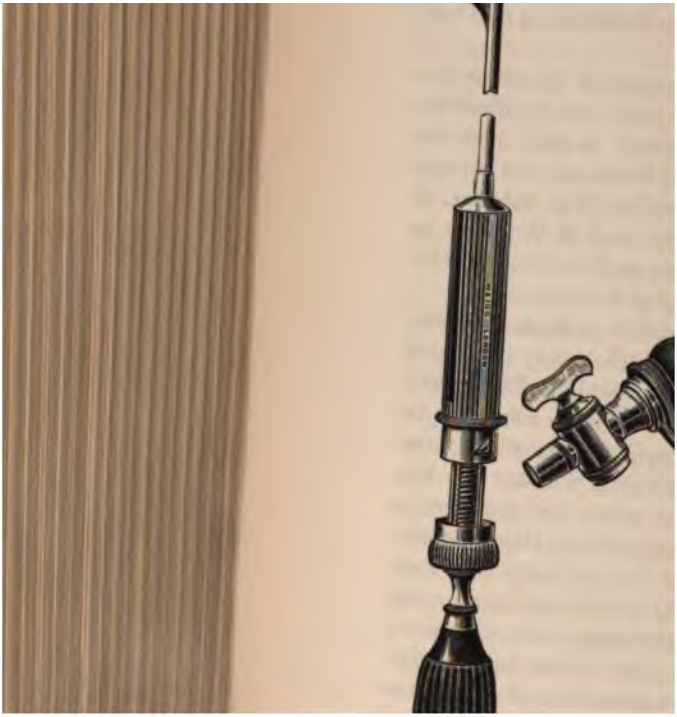
Diagnosis. — The symptoms pr
calculus have to be distinguished fr
phimosis, by congenital narrowing of
bodies impacted in the urethra, by cy
of the bladder. A small stone is reac
may often be discovered by adopting
by Surgeon-Major Freyer. He intro
catheter into the bladder, and app
aspirator filled with a solution of b
Alternate compression and relaxation
very soon bring even a minute stone
the evacuating catheter, with sufficie
presence in the bladder quite certain.

The presence of a stone of moderat
usually determined without difficulty
sound should be very blunt and very sl
it should be kept along the upper
whilst it is being passed. A bimanua
one finger in the rectum may alway
advantage in these cases, as owing t
the prostate, the bladder wall is in cl
front of the rectum. The child shou

before a sound is passed; its bladder should be emptied by means of a catheter, and should then be moderately distended with a solution of boric acid, 15 grains to the ounce, at a temperature of 100° F. Two to four ounces of such a solution are usually quite sufficient for a child of twelve years old.

Treatment.—As soon as the presence of the stone has been ascertained, the question arises as to how it should be extracted. There was but one answer to this question until 1885, for until that year lateral lithotomy was always performed and with excellent results. The labours of Keegan, Freyer, and Keith in India, and of Walsham in England, have shown that even more perfect results can be attained by litholapaxy or lithotrity at a single sitting.

Many surgeons prefer the suprapubic or high operation to either of the previous methods. Litholapaxy in skilled hands undoubtedly yields the best results. Those who have had the largest experience are able to employ it in nearly every instance; but it requires somewhat more ability than is possessed by the surgeon who has not the good fortune to reside in a district where the operation is of every-day occurrence. The suprapubic or lateral operation is therefore better adapted for ordinary use; and because many operators are deficient in boldness, suprapubic lithotomy is often preferred. *Litholapaxy* aims at removing the whole of the stone from the bladder at a single sitting, and, ideally, by a single introduction of the lithotrite. In children, calculi up to 60 grains—about the size of a Spanish nut—give the best results, though stones as large as an almond and weighing three drachms may readily be removed, and in skilled hands very much larger ones have been crushed, for Brigade-Surgeon Keegan reports the successful destruction of one weighing 703 grains in a boy of twelve.



as the worst accidents have followed upon a want of temper in the lithotrite. The lithotrite selected should be the largest which can be introduced into the urethra without force, and if necessary the meatus may be incised to facilitate its entrance. Nos. 5–8 are the sizes most frequently required for children over two years of age. It is important, too, to have the lithotrite fully fenestrated, as it is never used to extract fragments of the stone, and every particle should drop away from it before it is withdrawn from the bladder.

The evacuating catheter should only be slightly curved, and must be provided with a capacious eye close to the end and on its concave surface. An obturator or stylet should fit accurately along its whole extent, for it is essential to the success of the operation that no fragment of stone should become impacted in the eye, lest the urethra be lacerated as the catheter is withdrawn.

The evacuator should be in good working order and not too stiff. It is almost superfluous to say that everything must be aseptic.

The child is first anæsthetised; and as the operation is often a prolonged one, he may be put upon a warm water-bed. He is then placed in the Trendelenburg position (p. 391), or his hips are raised by placing a pillow beneath them, so that the stone lies upon the posterior part of the floor of the bladder rather than upon its trigone. The urine is drawn off, and the bladder is distended with four ounces of a saturated solution of boric acid at the temperature of the body. The lithotrite is introduced after incising the meatus; and if the operator possess a moderate familiarity with the instrument, there is usually no difficulty in grasping the stone.

The calculus should be reduced to the condition of fine sand, and every single particle must be withdrawn by the

evacuator, even though the operation
hour. The complete removal of every
importance that Mr. J. H. Morgan sug
is any doubt, it is as well to introduc
wash out the bladder three or four d
tion.

The patient usually recovers rapidly
is fit to go home in two or three days.

The dangers attending the operati
the bladder, laceration of the urethra, a
The error in crushing may be that too
stone is selected; in such a case the o
perform a suprapubic lithotomy withou
frequent error is that the stone is not c
and the fragments left in the bladder ac
formation of fresh calculi. Recurrence
when the operation has been performed
lithotritists.

Suprapubic Lithotomy appears to
suited for children, male as well as fema
the bladder is long and narrow, extendin
for a greater distance than in adults.
therefore an easy one, and is resorted to
not had a large experience in lithotrit
to lateral lithotomy on the ground tha
functions are endangered by the bruising
ejaculatory duct by the incision, and the
the other in extracting the stone. The
the Trendelenburg position (p. 391), upo
bed, after his rectum has been emptied
enema. He is anæsthetised, and his urine
a sterilised catheter. A saturated soluti
acid is then gently injected into the blad
line of the organ is dimly visible above

to six ounces are usually quite sufficient,—and a piece of drainage-tube is tied round the root of the penis to prevent the escape of the fluid. There is no need to put a Petersen's bag into the rectum.

The centre of the upper border of the symphysis pubis is next determined with precision. An incision two inches in length is then made through the skin, so that its lower half-inch lies over the centre of the symphysis. The incision is deepened until the recti muscles are seen. The recti are separated from each other, or their fibres are divided parallel to the incision and in its whole extent. They are afterwards held aside by small retractors. The peri-vesical tissue is usually of considerable thickness, and very vascular. It is, under ordinary conditions, divided cleanly with the knife, and with as little disturbance as possible, the scalpel being laid aside from time to time, so that the surgeon may assure himself as to the exact position of the upper border of the symphysis pubis, lest unawares he be working too high and injure the peritoneum.

There is usually no difficulty in recognising the denser and more vascular wall of the bladder, and as soon as it is seen, it is steadied with the fingers, and two aseptic silk ligatures are passed transversely through its muscular wall, one at the upper limit of the wound, the other immediately above the symphysis. The ligatures are held taut by an assistant, and the surgeon plunges his scalpel into the bladder wall and divides it vertically from above downwards through its mucous as well as its muscular coat. Fluid at once escapes, a finger is introduced, the stone is felt, and is removed by a pair of forceps. The wound in the bladder may be closed at once with two or three catgut sutures by Lembert's method, if the urine be normal and there is no cystitis—the usual condition in children. The external wound may also be closed in such cases, and

an attempt made to obtain union by
urine being repeatedly drawn off
catheter.

Drainage of the bladder must be
urine is unduly foul, and Prof. Sen
in such cases the operation should be
stages. The bladder is first exposed, a
fat is dissected away over an oval spac
vertical. The wound is then packed w
and dressings are applied for four to si
of granulations have been formed.
absorption is thus reduced to a mini
can then be opened in the ordinary wa
been painted with cocain. In these
Mr. Southam suggests that the bladde
satisfactorily by drawing the bladder al
by afterwards introducing the nozzle
syringe into the urethra, and thus washi
per urethram. By this method of "u
which should be practised daily until the
a current of boric lotion is passed
bladder, entering at its base and leaving
opening, so that it is washed out very e

The operation of *lateral lithotomy* h
any modification; and as the various ste
every text-book on surgery, and with es
the peculiarities of the operation in child
further considered in this book.

Prostatic Calculi.

Prostatic calculi occasionally occur in c
must of necessity be extremely rare, ow
mentary state of the gland.

Urethral Calculi.

Urethral calculi are not uncommon, and are generally vesical calculi which have become impacted either in the membranous or penile portions; much more rarely they are formed in the urethra itself. They may give rise to complete retention of urine, and they are readily diagnosed by the passage of a sound into the urethra. When a calculus is so firmly impacted that it can neither be pushed back into the bladder nor withdrawn by the urethral forceps, it may be necessary to incise the penis longitudinally along its under surface. This method, however, should only be adopted as a last resource, as I have seen a troublesome penile fistula result from it.

Præputial Calculi.

Præputial calculi are sometimes found in the corona glandis during the performance of circumcision. They are usually calcified masses of smegma. In a few cases they may have escaped from the bladder, and Dr. William Hunt therefore suggests that when they are met with the child should be sounded.

TUMOURS OF THE BLADDER.

Myxomata and papillomata are less frequent in the bladders of children than sarcomata. A primary cancer has only once been recorded.

Symptoms.—Vesical tumours cause difficulty in micturition, with pain either during or occurring independently of the passage of urine. Hæmaturia, although it is sometimes profuse, is less frequent and is not so marked a symptom as in adults. It sometimes commences spontaneously, but it is more often observed for the first time

after the child has been sounded or passed. The flow of urine is often i sometimes complete retention. The tion, in the later stages, may lead to a fistulous tract in very young child of the allantois may re-open, so that through the umbilicus.

Diagnosis.—The great capacity for by the female urethra always allows th from a girl's vulva, and so renders the and the diagnosis easy. In boys, whe is possible, the symptoms are often caused by a stone in the bladder; nor guish them. The urine hardly ever c the growth, and the passage of a s tumour which seems so hard that it for a stone. Rectal and bimanual exa anæsthetic will often enable the su enlarged bladder with thickened walls of such an examination may be negati of the bladder may be mistaken for ret to the infiltration of its walls with sar the organ does not contain much urine, distended, even after it has been laid o the growth of the tumour causes paraly walls of the bladder, and the urine ma in it.

Treatment.—The injection of a solu perchloride of mercury at a temperatu relieves the dysuria, especially if cystit if necessary, its strength may be gradu increased. In girls an attempt may b the tumour through the urethra, but in cystotomy must be performed if the

urgent, and the growth must be removed by cutting forceps.

Prognosis.—The result of the operation in boys is so disastrous that it is only performed as a last resource, and in girls nearly all attempts to remove malignant growths have terminated fatally within a few months, for the sarcomata of the bladder follow the ordinary rule that in children all malignant growths run a very rapid course.

CHAPTER XXIII

SURGICAL AFFECTIONS OF THE URETHRA

RUPTURED URETHRA.[54]

Causes. — Rupture of the urethra takes place rather frequently in boys from direct violence, as by falling astride a bar, whilst sliding downstairs, or from a kick upon the perineum; but it is sometimes the result of indirect violence, or it is a complication of fractured pelvis.

The rupture is either partial or complete, and its diagnosis is usually so easy that it is not likely to be mistaken for any other injury.

Symptoms.—There is generally severe pain, with greater or less difficulty in passing water. A tense and tender swelling forms in the perineum, and there may or may not be bleeding from the orifice of the penis.

Treatment.—The treatment in the slightest forms, where micturition is not interfered with, when there is little or no bleeding, and when the perineal swelling is very small, must be expectant, for it is possible that the urethra may only be bruised. The boy must be put to bed, and the swollen perineum must be carefully watched, to see that no suppuration or extravasation of urine takes place.

If the temperature rises, the perineal hæmatoma should be incised, the clot turned out, and its cavity cleansed.

The condition of the urethra should be examined at the same time; if it is partially lacerated or completely torn, the two ends must be found and united. It is always easy to find the anterior extremity, for a catheter can be passed through it along the penis; but it may be impossible to discover the posterior portion. The search is facilitated in such cases by remembering that the posterior portion of the urethra generally lies nearer to the anus than the penile part, and pressure upon the bladder will often enable the surgeon to squeeze a few drops of urine along the urethra, and this will serve to indicate the position of the vesical portion.

It is considered advisable by some surgeons to pass a rigid catheter along the urethra into the bladder. They then perform suprapubic cystotomy. The bladder being opened upon the point of the catheter, the opening should be enlarged until it easily admits a large-sized drainage-tube. The catheter should be withdrawn, and as many sutures inserted into the urethra as seem to be necessary. Four are generally sufficient for a complete rupture: one in the roof, one in each side, and one in the floor. The suture in the roof should be tied first. As large a catheter as the urethra will admit should be passed, to support the wounded edges, and to prevent them from folding inwards. The remaining sutures are tied in, and the catheter is removed with the greatest care, so that its point does not stick either into the roof or into the floor at the sutured part. The whole or part of the perineal wound may then be brought together.

The suprapubic drainage may be continued for ten days; and during this time no catheter should be passed, and no urine should be allowed to flow through the urethra. The bowels may be kept confined for a week. It is difficult, even in children, to obtain union by first

intention in these cases. When th
laceration, and the ends of the uret
together, a catheter may be passed
the deep perineal tissues may be
catheter being left in position as lon
eventually takes place, and the
required to prevent the formation of
is so much less after operation th
methods of treatment have been ad
worth while to suture the urethra i

PROLAPSE OF THE FEMA

There are several cases on record
in little girls has become prolapsed.

Ætiology.—The exciting causes
dition are unknown; but the pre
general weakness, local irritation
bladder, and repeated straining, as
cough or with habitual constipation.

Symptoms.—The symptoms are
condition often passes unnoticed for
There may be increased frequency
scalding and sometimes bleeding.
vulva shows the presence of a red
furrowed with longitudinal ridges,
a central depression forming the orifi

Diagnosis.—The prolapse may
nævus, polypus, or for a urethral caru

Treatment.—Simple replacement,
case, is sometimes sufficient to cure
other cases, washing with cold wate
application of solid nitrate of silv
constriction to prevent any recurre

obtained satisfactory results by drawing forward the prolapsed portion with a tenaculum, and then snipping it off.

PHIMOSIS.[56]

Phimosis, in its strict sense, is that condition in which the prepuce is unduly long, and its orifice is so narrow that it cannot be retracted; but the term is often applied to those cases in which, from a persistence of the fœtal condition, the prepuce is more or less firmly attached to the glans penis.

Sequelæ.—Phimosis often leads to urinary troubles, either in the shape of dysuria and retention of urine, or, in its more advanced forms, to thickened and contracted bladder, with hydronephrosis (fig. 55). Extravasation of urine in infants is an occasional result of phimosis. It may also be the cause of balanitis, and more remotely of umbilical and inguinal hernia, though there are many good reasons for thinking that phimosis does not usually stand in any direct causal relation to hernia. It is said to lead to the more common forms of hydrocele, whilst masturbation and sexual incontinence may be associated with its presence. In many cases the orifice in the prepuce is not opposite the urinary meatus, so that when the child passes urine, the prepuce is distended into a transparent sac, and he is then promptly brought for surgical treatment.

Treatment.—When the orifice of the prepuce is wide, and the adhesions are few, a cure may often be wrought by retracting the prepuce, separating all the adhesions, and clearing away the smegma which has been secreted into the furrow behind the glans.

Forcible dilatation of the prepuce in true phimosis is useless. I tried it most thoroughly, and in many cases,

for a year, and satisfied myself
The prepuce cannot be retracted w
or completely rupturing it. Th
badly, or cause a chronic irritatic
much induration as to require re
I therefore content myself with
of phimosis, though it is by no m
form it on every child, or even on t
who have a long and narrow foreski

Circumcision.

Circumcision is performed at an
child is healthy. The ideal to b
plastic operations, is to obtain so g
fact of surgical intervention havi
not at once apparent; and to obtai
by first intention is of the utmo
operation is so frequent in children t
his own way of performing it. It i
for balanitis, and more rarely afte
method I usually adopt is to render t
if possible, to retract the foreskin
away all the smegma preputii.

The child is anæsthetised, and an
root of the penis to arrest bleeding
against the pubes. The foreskin is t
and is cleanly snipped off with a pai
ately in front of the glans; the in
obliquely forwards from the dorsu
The mucous membrane of the prepu
raw surface, covering the glans; it is
corona by passing a probe or director
This is generally easy, for the adhe
the prepuce has sometimes to be actu

glans, and at other times its margin is continuous with the urethral mucous membrane. These cases are often very unsatisfactory, for the prepuce contracts fresh adhesions to the raw surface of the glans, or the orifice of the urinary meatus afterwards contracts, and when it has been slit up, again contracts.

There is usually no difficulty in separating the mucous membrane of the prepuce from the glans. As soon as the separation is complete, the præputial mucous membrane is divided longitudinally either with a scalpel or with a pair of blunt-pointed scissors, taking care that the urethra is not cut at the same time. The mucous membrane is then turned to either side, the smegma preputii is removed, and the sulcus is thoroughly cleaned with pieces of wet absorbent wool.

The preputial mucous membrane is next cut away, near the glans, but not absolutely on a level with it; for after a well-performed circumcision there should be a slight but sufficient covering for the lower part of the glans, and there should not be the tight retraction with disappearance of the sulcus which is too frequently seen after the operation.

The frænum in many cases may be left untouched; but if the tissue in its neighbourhood appears to be redundant, I do not hesitate to trim it up; and if it be too short, as is often the case, it may be entirely removed, and a new one formed. Dr. Félizet's method is a good one for this purpose. The penis is raised so as to expose the triangular raw surface on the under surface of the glans (fig. 53). Two horsehair sutures, 1 and 2, are then passed through the edges of the skin. The suture (1) nearest the meatus is tied in a reef-knot, and cut short.

The lower suture (fig. 54, 2) is tied in a "granny," so that the ends lie parallel with the line of incision.

A needle is again threaded to the lower end of the suture (fig. 54, 3), and is made to traverse the cut margin of the skin of the penis. It is then tied to the upper end of the lower suture (fig. 54, 2), and by this means the skin of the penis is approximated to the glans.

The assistant now relaxes his hold on the root of the penis, and the bleeding is arrested. This is rather sharp in young children, and I attach the greatest importance to its complete arrest, as union by first intention cannot be obtained when the two cut edges of the wound are

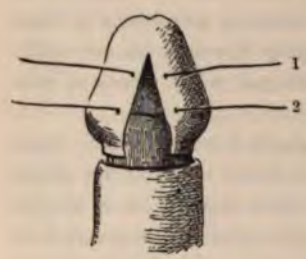


FIG. 53.

FIG. 54.

FIGS. 53, 54.—Diagrams showing Félizet's method of forming a new frænum during the operation of circumcision.

separated by blood-clot. It is therefore worth while to take some little trouble in stopping it. The bleeding usually takes place from the artery of the frænum. These often need a very fine catgut ligature, whilst the venous hæmorrhage, which is sometimes troublesome, may be stopped by pressure forceps.

The parts are then gently irrigated with a solution of boric acid or perchloride of mercury; and when the operation has been performed upon a healthy child with an uninflamed prepuce, it is usually sufficient to slide the

skin forwards over the mucous membrane, so that the two raw edges are in contact. The part is dried, and a single strip of cyanide gauze is wrapped round the wound, and painted over with collodion, taking care to leave the meatus patent. If the foreskin has been inflamed, it is better to unite the edges of the wound at one or two points with sutures of horsehair.

The dressing is completed by passing the penis through a hole in the centre of a piece of absorbent cotton-wool or of Gamgee tissue. It is then slung against the abdomen by means of a piece of strapping, which is sufficient to keep it raised, but is not applied tightly enough to cause any risk of strangulation, even though the organ should become swollen. The thighs and knees should be lightly bound together for a few hours after the operation, to prevent the dressings being disturbed.

After-Treatment. — The after-treatment consists in keeping the child at rest until the wound is healed. The dressings will not require changing until the second or third day, if directions be given to the child's attendant to prevent their becoming soiled; at the expiration of this time they are allowed to soak off in a warm bath. It may be necessary to reapply them, or it may be sufficient to dust the penis with nitrate of bismuth after bathing it in a weak solution of corrosive sublimate. I do not consider it necessary for a child whose urine is healthy to micturate with its penis in an antiseptic solution, as many surgeons recommend.

Accidents.—The operation is usually straightforward, but a due proportion of accidents attend it. A certain amount of shock is often noticed during the period of anæsthesia. It is most often seen in the ill-fed, and in children who have been kept too long without food. During the operation, when the prepuce is adherent to the epithe-

lial lining of the urethra, the mucous
picked up with a pair of toothed
incised along the dorsum of the penis
circularly, and its anterior portion dis
urethral orifice. In other cases the
hypertrophied, as a result of chronic i
inexperienced operator may dissect
anxiety to avoid the glans, and may
indurated tissues. Care must be take
not to remove too much skin in cases
very small and has become retracted
of cold.

The bleeding is usually slight and
as the vessels of the penis are very co
ally happens that the operation may
before they have relaxed. Serious los
takes place from this cause, as the hæ
be overlooked because the blanching
attributed to the effects of the anæst
should therefore assure himself that th
before he leaves it, or he should, at any
to the nurse not to trust too much
actually to see for herself from time to
ings are not becoming blood-stained.

Union by first intention can generally
suppuration happens pretty frequently
siderable amount of œdema, or the tissu
In a few cases the child may die of py
tion. In the slighter cases of sup
should be repeatedly bathed in a solut
mercury, and gauze dressings should b
flamed part. Stimulants and quinine
tered to the patient in these cases.

Care should be taken after the op

FIG. 55.—Bladder and kidneys from a lad of 17 years, showing the baleful effects of an untreated phimosis.

[From specimen 2370 (a) in the Museum of St. Bartholomew's Hospital.]

retention of the urine does not occur. I
oneself, before circumcising, that the k
in children who have had a tight phim
occur from acute suppurative nephrit
case, which came under my notice a f
exemplifies the value to be attached to
the urine in these cases. An apparentl
acted as a railway porter at a country
himself fresh from his work, and with
that a probe could not be passed thr
the foreskin. He was circumcised, and
began to suffer from symptoms of suppr
became comatose, had uræmic convulsi
days after the operation. The annexed
of the genito-urinary organs shows how
is enlarged and hypertrophied. Its m
ated. The ureters are enormously disten
except at their point of entrance into t
they are normal in size. The pelves a
the kidneys are widely dilated, thicken
a deposit of lymph upon their inne
glandular substance has entirely disapp

A similar condition of the genito-
sometimes found after phimosis leading
urine. Dr. Alexander James[56] believe
of this condition can be obtained from
specific gravity of the urine, and the
small amounts of albumin. Mr. Burn
called attention to similar cases.

BALANO-POSTHITIS

The foreskin is a peculiarly vulnerabl
children, and the surgeon is constantl
inflammatory conditions occurring in it.

flammation of the foreskin, is nearly always associated with balanitis, or inflammation of the glans penis, and it is therefore convenient to consider the two conditions at the same time. Balano-posthitis is due to general as well as to local conditions.

Causes.—Phimosis is one of the commonest causes, for it leads to a retention of smegma, which may decompose beneath the foreskin, or it sets up inflammation owing to the irritation produced by partial adhesion existing between the glans and the mucous lining of the prepuce. The dribbling of urine over a long foreskin may cause an eczema which in turn becomes a balano-posthitis. Diabetes, gonorrhœal discharges, and soft sores more rarely give rise to this condition in older children. Irritation of the urinary tract from the presence of calculi and from Bilharzia, or of the rectum from thread-worms, also causes inflammation of the foreskin. It may be produced by injury, and it sometimes occurs after circumcision. The constitutional causes are the exanthemata, especially scarlet fever and measles, erysipelas, diphtheria and tubercle, or rather that predisposition to tubercle which is now called struma. It also occurs in those children of gouty parents who have inherited the uric acid diathesis.

Symptoms. — In the simplest form the foreskin becomes red, swollen, and œdematous, and, if it be left untreated, soon exudes a clear, serous fluid. The œdema extends some distance down the penis, and generally terminates abruptly.

Treatment.—This condition usually subsides if the penis be slung against the abdomen after it has been thoroughly cleansed by giving the child a warm bath, and by the local application of subnitrate of bismuth, or of equal parts of starch and oxide of zinc. The child should be circumcised as soon as the acute symptoms have sub-

sided. The inflammation is so acute
part or the whole of the prepuce may
or it may be sloughing from the
require much more active treatment.
of brandy should be administered dail
of laudanum three times a day for a
The penis should be raised, and should
with hot water. The prepuce should
complete retention; otherwise no cutti
be performed until the child is in a be
Suppuration does not often take place;
the abscess must be opened at once.

Paraphimosis.

Paraphimosis occurs more often in
in infants. It necessarily has a phim
dent condition.

Symptoms.—The symptoms are due
gestion produced by a tight and retract
the arteries continue to carry blood to
strangulation is thus produced, the
œdematous, and the glans swollen and
spite of this, gangrene is not a ver
Similar symptoms are produced in child
cation of ligatures to the penis, so that
ascertain that nothing is tied round th
attempts to reduce a paraphimosis.

Treatment.—The treatment of parapl
relieving the constriction as soon as poss
done by returning the prepuce to its n
incising it or by cutting it off. Reduct
placing the patient on a bed and anæsthe
surgeon stands upon the right side and
between the second and third fingers

whilst he grasps the swollen glans in the fingers and thumb of his right hand. He squeezes the glans with his right hand, so as to reduce its size as far as possible by rendering it bloodless, and he simultaneously pulls the prepuce forward and pushes the glans backwards until reposition is effected. When this has been done, the surgeon should be careful to ascertain that the reduction is real and not apparent, for it sometimes happens that the foreskin is pulled into place whilst the preputial mucous membrane is left behind and remains as a constricting band. The operation is often a long and difficult one, and the foreskin may be much chafed. To facilitate the reduction, the glands may sometimes be emptied of blood by bandaging the penis from its point towards its root.

The penis should be thoroughly washed after the reduction with a 1 in 1000 solution of corrosive sublimate, and its end should be wrapped in wet cyanide gauze. The patient must be kept in bed for a day or two.

Operative treatment is to be adopted as soon as the surgeon has satisfied himself that manipulation is useless. A probe-pointed bistoury is slipped between the glans and the prepuce along the dorsum of the penis, and the constriction is freely divided. This is usually sufficient to permit the prepuce to be drawn forwards, but it is sometimes necessary to make small oblique incisions from the end of the dorsal wound before the prepuce can be replaced. It is not advisable to circumcise immediately after a paraphimosis has been reduced, as the tissues are too inflamed to heal by first intention.

Dislocation of the Penis.[37]

The penis in children occasionally becomes displaced as the result of direct violence, so that it lies within the

scrotum. Reduction has been effected
lation as late as the tenth day after th

ENURESIS.[58]

Few patients are more often seen by
attached to a Hospital for Children t
from incontinence of urine, and for fe
done by treatment. The incontinence
nocturnal; but involuntary passage o
day is not a very uncommon affection i
ages of six and twelve who are overwor
causes of enuresis, and the methods re
treatment, are nearly as numerous as
themselves.

Ætiology.—Essentially a physiolo
nected with an ill-developed sphincter
associated with phimosis, with constrict
meatus, or with other parts of the
chronic irritation of the bladder, rectu
vesical growths, worms, or stone. It is
nection with chronic nephritis and py
and vesical calculus, and with alteratio
gravity and in the reaction of the urine.
more rarely, be associated with disorde
nervous system, characterised by epilepsy
or with congenital defects of the spina
with spina bifida, either of the ordinary t
common form of spina bifida occulta. It
early symptom of diabetes, and I have s
quently associated with slight but chro
sumably tuberculous in origin, and in so
Pott's disease of the spine. It is, perhap
with in the two extreme types of intelle

children—those who are unduly bright, precocious, and excitable, and in those who are of low mental calibre.

Treatment.—The affection is a very obstinate one, but it should, as far as possible, be treated causally. When no cause can be detected, the passage of as large a sound as the urethra will admit is often followed by good results, especially if the sound is cooled by being placed upon ice before it is oiled. This treatment, first used by Mr. Edmund Owen, has recently been placed upon a scientific footing by Prof. Peyer, who shows that it is most serviceable in cases of chronic irritation of the prostatic portion of the urethra—a condition which is often found in boys who masturbate. It is indicated by the presence of a considerable quantity of clear mucus entangling crystals of triple phosphates in the sediment of urine which has been allowed to stand for a few hours in a conical glass vessel. Epithelial cells, leucocytes, and, in older boys, more or less well-developed spermatozoa repeatedly found in the urinary deposit, will go far towards establishing a diagnosis of masturbation. The sound in these cases should be passed at least twice a week; but in bad cases it may be necessary to perform the operation daily. It should be left in the urethra for five minutes on each occasion.

The ordinary adjuvants to treatment must be adopted in every case, such as tonics, waking the child to pass water when its attendant goes to bed, giving it light and digestible meals with a minimum of fluid in the daytime, and none in the evening. The general tone of the system may be improved, with benefit to the local defect, by sponging the body with sea-water, and then briskly rubbing it with a bath-towel until a glow is felt. It is often advisable also to prevent the child sleeping upon his back.

I have only obtained good results in the slightest cases from the administration of belladonna even in large doses,

and when mixed with nux vomica; but the treatment should always be tried before other measures are adopted. Dr. Baruch's method, recommended by Mr. Edmund Owen in his Lettsomian lectures, is easy to recollect, and is as satisfactory a way of administering the drug as any other. He orders—

℞ Atropiæ sulphatis, grain i.
Tinct. Aurantii, drachm i.
Aq., ounce i.

M. et fiat Mist.

Dose, one drop for each year of the child's age. Administer it every hour in the late afternoon, or until the pupil is dilated at bedtime, and give a dose or two during the night, should the pupil begin to contract. The object of this method is to get the patient so thoroughly under the influence of the drug, that the pupil remains dilated whilst the child is asleep. Antipyrin in two-grain doses may also be tried. Two doses should be given at intervals of an hour, the last being taken just before the patient goes to bed with an empty bladder. The drug has been greatly extolled, but I have never obtained any satisfactory results from its use. Astringent injections of a 1 per cent. solution of alum, tannin, or a 1 per 1000 solution of nitrate of silver, may also be tried in very obstinate cases. Three or four suppositories daily, each containing ¼ grain of nux vomica, are also said to be serviceable; and Von Tienhoven recommends that the foot of the bed should be raised to an angle of 45°.

CHAPTER XXIV

SURGICAL AFFECTIONS OF THE TESTICLE

TUBERCLE OF THE TESTICLE.[59]

Lloyd, in his work on scrofula, published in 1821, was the first to refer to tubercle of the testis occurring in a child. The affection is rather a rare one; but Demme's statistics, which give it as sixteen times in 1,932 cases, appear to be more correct than Jullien's, who only noticed it sixteen times in 5,566 tubercular children. For several years past one or two cases have annually come under my notice at the Victoria Hospital for Children.

Ætiology.—Tuberculous testis affects children of all ages, and it has even been found to be congenital. One gland is, as a rule, infected, and a definite history of injury can often be obtained. The disease may be primary, but it is more often seen as a secondary affection in the course of general tuberculosis.

Symptoms.—The disease presents certain differences in the course which it runs from the similar affection in adults, due no doubt to the fact that the gland in children is not functional, and is therefore of far less importance than it is in later years. The onset of the inflammation is often so insidious that the mother only accidentally discovers that the child has a swollen testicle. The gland, on examination, is then found to be larger than usual, and to present a hard mass, with a more or less irregular

outline. This mass is situated either in the body of the testicle. The glan usually there is no hydrocele. It m who otherwise appear to be in suc make one doubt the correctness of one'

The affection sometimes begins wit toms. The skin of the scrotum bec œdematous, somewhat reddened, and formed. After a few days these syn an enlarged and tender gland or a kn be felt within the scrotum.

Prognosis.—The prognosis in case culous infection of the testis is good. T remains stationary for a longer or shor slowly diminishes, and finally disappear disappearance may be so complete tha phies at the same time, and the child b The result is far otherwise when the a mixed one; that is to say, where c bacilli alone are deposited in the gla then produced which opens through th a fistulous tract. Hernia testis is ra bouring glands are early affected. cases are often accompanied by tubercu sidious spinal caries, or manifestations o The vas, vesiculæ, and bladder are on volved. Mr. Bennett's interesting pap Disease of the Testicle" [59] as a local affec some cases the vertebral column is impli culous inflammation which has commenc even before the disease has spread to th of the same side. The dissemination d take place until the original focus of the to undergo degenerative changes, and t

does not become affected until some time after the formation of an abscess.

Diagnosis.—There is usually but little difficulty in making a diagnosis, but care must be taken not to mistake tuberculous disease for syphilis, sarcoma, or dermoid cysts. A tuberculous testis cannot always be differentiated from a syphilitic one. In syphilis, both the glands are generally involved; in tubercle, only one. Syphilis may transform the testicle into a hard and painless mass, the epididymis remaining unaltered; whilst in tubercle the gland is usually tender and the epididymis is affected. In syphilis, too, there is often other evidence of the inherited disease; and, in the earlier stages, there is a rapid and marked improvement when grey powder is administered. Sarcoma of the testis is rare in children; it grows more rapidly, is much less circumscribed, and shows less tendency to suppurate. Dermoid cysts are so rare that they need only be mentioned.

Treatment.—The treatment in all simple cases, where there is no tendency to suppurate, should be purely palliative. Fresh air, cream or cod-liver oil, good food and plenty of sleep, with a light suspensory bandage and the inunction of blue ointment, are generally sufficient. Care should be exercised, even in those cases which appear the most harmless; for it should be remembered that tubercle bacilli are present in the gland, and that they may, at any time, and most insidiously, infect the bones and serous membranes, peritoneal, pleural or meningeal.

The testicle should be removed at once if there is the slightest evidence of dissemination. It should also be removed, and with it the infected skin, in all cases of extensive disorganisation of the gland which has been allowed to proceed as far as the formation of sinuses.

TUBERCULOUS EPIDIDYMITIS.

Chronic inflammation of the epididymis is by no means rare in children who have other manifestations of tubercle. It occurs as an indolent swelling, which gradually increases, suppurates, and may burst, leaving fistulous tracts. Jullien, who has paid much attention to this form of disease, says that he has never seen it in a case of undescended testis, and Gerster maintains that it is embolic in origin. The prognosis is good, though death sometimes takes places as a result of general tuberculosis.

Treatment.—The treatment is the same as for tuberculous disease of the testicle itself. Three or four drops of camphorated naphthol may be injected into the substance of the swelling if it be seen before suppuration has taken place; but if fistulæ are present, it is better to excise the whole testis.

ABSCESS OF THE TESTIS.[60]

Mr. Sheild quotes two cases of simple suppuration occurring in the testicles of infants. They are of uncommon occurrence, and I have never seen a case. They are to be treated by the ordinary method of early incision.

Displaced Testis.

A testicle may be displaced either from defective action of the gubernaculum testis when it does not lie in its proper position in the scrotum, or it may be displaced owing to irregular action of the muscle, in which case the testicle may not be situated in the scrotum at all. The gland in cases of retained testis may lie within the abdomen, in the inguinal canal, or at the top of the scrotum. In cases of ectopic testicle the organ may lie either in the groin or in the perineum, for the gubernaculum testis has

attachments in the perineum as well as in Scarpa's triangle. Ectopia perinealis is the commoner form. It is either scroto-femoral when it occupies the groove between the scrotum and the thigh, or it is perineal when it lies behind the scrotum near the middle line and at a varying distance in front of the anus.

Diagnosis.—There is no difficulty in recognising that one testicle is absent from the scrotum, though the defect is often masked by the presence of a hernia or of a hydrocele. It is more likely to be overlooked than to be mistaken for any other condition. The scrotum is sometimes badly developed upon the affected side in cases of an undescended or of an ectopic testis.

Ectopia femoralis may be mistaken for an enlarged lymphatic gland, for only a few years since such a gland was sent to me, removed from the groin, as was supposed, for tuberculous enlargement. Examination, however, showed that it was a healthy and functionally active testis.

Ætiology.—Displaced testes are so rarely functional, that it is a question whether the displacement and the want of function are not both due to deficiency in the spermatic artery, rather than that they are correlated as cause and effect. The exact ætiology, however, is unknown.

Treatment.—In cases of inguinal hernia, complicated with retention of the testis, the rupture is generally found below or on one side of the gland. The radical operation for the cure of the hernia must be performed in such cases in the manner already described (p. 417). The testis may at the same time be brought down into the scrotum as far as the cord will allow, and sutures should be passed through the pillars of the ring. The sutures are generally sufficient to prevent the reascent of the testicle, but it is sometimes necessary to still further secure it by means

of an aseptic silk ligature passed th
the skin at the base of the scrotu
orchidopexy, as it is termed, has rece
of keen debate amongst the surgeons
no means unanimously in its favour.
be done early if the rupture is large
keep up, or if from any cause the w
painful or unsatisfactory. It shoul
until the child is more than five year
cases there is an arrest of the normal

A testicle lying in the perineum i
place by a band of fibres which may
to the tuberosity of the ischium, to th
of the anus, or to the skin. The subc
this band occasionally allows the test
in the scrotum. When this fails, th
recommended by Mr. Bilton Pollard
even when the scrotum is badly deve
is first exposed, and is raised with its
the cremaster muscle, and turned upw
external abdominal ring. An incision
lower part of the scrotum, and a bed
testicle amongst the connective tissue
forceps is thrust up from the woun
through the cellular tissue to the top o
close to the external abdominal wound.
by separating the blades of the forceps,
pushed along it as gently as possible
Both wounds are then closed, and they s
intention.

MALIGNANT TUMOURS OF TH

Carcinomata are of less frequent occu
mata. They are usually congenital, ar

rapid course, they are only seen in the youngest children. Sarcomata occur in older children, and their origin is sometimes referred to an injury to the testicle.

Symptoms.—The tumour primarily involves the epididymis or the body of the testis, and is often undergoing cystic degeneration. It is generally smooth, heavy, and hard, but its shape and even its existence may be masked by the presence of a hydrocele or a hæmatocele. It is painless, and testicular sensation is lost early.

Diagnosis.—The affection is most likely to be mistaken for tubercle or syphilis, but the rapid increase in its size will soon point out its true nature.

Prognosis.—The lumbar glands may become affected, and I have seen a diffuse sarcomatous infiltration of the entire peritoneum spreading from the epididymis up the spermatic cord without any infiltration of the glands.

Treatment.—Early removal of the affected testis is imperative. The prognosis is bad, for secondary deposits nearly always develop.

Innocent tumours of the testicle in childhood are rare. There are a few cases of true enchondroma recorded.

TORSION OF THE SPERMATIC CORD.[61]

Nicoladoni, in 1885, first called attention to a remarkable accident in which the testis becomes strangulated owing to twisting of the spermatic cord up to or beyond an angle of 180°. Mr. Bryant, Mr. Gifford Nash, Mr. Edmund Owen, and Dr. R. W. Johnson have recently published cases in which such an accident has occurred. I am particularly indebted to Mr. Bryant for the readiness with which he placed at my disposal the block (fig. 563) representing the appearances observed in the case which he published in the 75th volume of the *Medico-Chir. Trans.*

Ætiology.—The condition may
in the scrotum, but it is more often
or partially descended testis, and
ages, though it is most common i
predisposing cause is the freedom
is suspended in the scrotum, asso
thinks, with a flat form of testis,
cord into two sections, and with

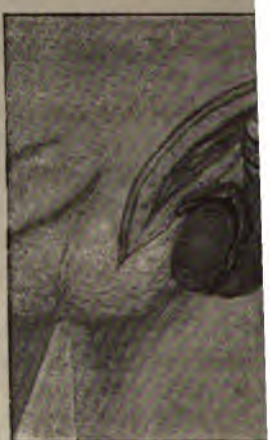


Fig. 56.—Torsion of the sperm
[*Copied, by Mr. Bryant's permission, from the "Tra*
Chirurgical Society."]

the tunica vaginalis, leading to an ur
constituents of the spermatic cord.
are unknown, for the accident has som
such prolonged jarring as would b
bicycle ride, by boxing or by jumping
no cause has been assigned.

Morbid Anatomy.—The tunica v
inflamed, and it usually contains fl

cord is twisted upon its axis either once or more than once, and usually in a lævo-rotatory direction. It is often gorged with blood, and the pampiniform plexus may contain thrombi. The testis or the epididymis, or both, may be acutely inflamed, and, if the strangulation has been left for some time, the inflamed part may become gangrenous and exfoliate, or it may atrophy. Miflet has endeavoured to explain this by showing that the branches of the spermatic artery supplying the testis itself are terminal arteries, whilst those which supply the epididymis anastomose with the artery of the vas. Interference with the blood-flow in the terminal branches of the artery is therefore followed by hæmorrhagic infarction of the superficial layer of the testicle, whilst the epididymis remains comparatively free. This explanation, however, does not hold good for those cases in which the epididymis is alone or chiefly affected.

Symptoms.—The symptoms are a painful swelling, which appears suddenly in the groin or scrotum, dull on percussion, irreducible, and without any impulse on coughing. The consistence of the swelling is firm and doughy. The scrotum may be red and œdematous. The abdomen in some instances is distended and tender. There is often some rise of temperature, with a quickened pulse, and some symptoms of shock. Sickness is a very constant symptom, and constipation is frequent, though it is not absolute.

Diagnosis.—It is not surprising that with such a history and with such symptoms the greater number of cases in which this accident has happened have been diagnosed as instances of strangulated hernia, though it is possible to assume that it was due to gonorrhœal or traumatic inflammation of the testis and epididymis.

Differential Diagnosis.—A diagnosis between twisting of the spermatic cord, a strangulated hernia, and a bubo,

has to be made. There is more shock in cases of hernia, the external ring contains a tumour, and the spermatic cord is masked by the swelling. A bubo, unless a testicle is absent from the scrotum, is recognised by the absence of shock, the patent abdominal canal and the normal cord.

Prognosis.—The result depends upon the severity of the torsion. If the cord is only slightly twisted, it may recover itself, the testis remaining natural in size, but inverted, *i.e.* the epididymis may lie in front of the testis. In more severe cases, when the vascular supply is interfered with and infarction has taken place, the testis becomes swollen, congested, and eventually atrophies. Gangrene of the organ quickly ensues in the most severe cases, when the twisting has been extensive.

Treatment.—The spermatic cord and testis must be exposed as soon as the condition is recognised, for taxis is clearly contra-indicated. The cord should be untwisted if it appears reasonable to suppose that the inflammatory conditions have not already advanced too far to save the organ. A retained testicle, or one which is very much swollen or discoloured, is best removed, for it will either atrophy or die.

DERMOID CYST OF THE TESTIS.

Dermoid cysts of the testicle are occasionally met with. A few years since I showed one which had been removed from a child four years old, in whom it had been observed for three years.

Morbid Anatomy.—Examination of such a tumour shows cysts lined with slightly altered epidermis, from which hairs may spring. The solid parts of the tumour consist of dense fibrous tissue with fat, and eyots of cartilage may also be present.

Symptoms.—The tumour in my case was smooth, ovoid, regular in outline, and heavy; there was a sense of fluctuation in parts, but there was nowhere any translucency. No nodules could be felt on palpation, but the fluctuating parts were less resistant than the rest of the gland. The testicular substance could not be felt, and the epididymis was imperceptible. The tumour was increasing slowly in size. The scrotum appeared to be normal, and was free from any scar.

Treatment.—The only treatment for these tumours is removal.

HYDROCELE.[62]

Varieties.—Hydrocele is of very common occurrence in children of all ages. It is either congenital or acquired. The acquired form is either single, and is a hydrocele of the funicular process shut off above and below, or it is a hydrocele of the tunica vaginalis. Double acquired hydrocele is sometimes met with after acute diseases, and is most frequently seen after scarlatina. The sac is usually simple, but it may be multilocular. Hydrocele of the testicle in children is in reality a chronic serous periorchitis, and may begin acutely.

Acute Hydrocele.

The acute cases are generally seen in children of fifteen days to six weeks old. The hydrocele is associated with an erythematous condition of the skin of the genitals, and is often associated with digestive disturbances. It is limited to one side, and is very tense and elastic. It lasts from two to six weeks, and is amenable to treatment, for it disappears with the skin eruption. The treatment, therefore, consists in correcting the digestive disturbance, and applying vaseline or boric acid in powder to the affected parts.

Chronic Hydrocel

The causes of chronic hydrocele
The congenital form is said to be d
those developmental changes, cutting
between the peritoneum and the tuni
ought to be completed before birth;
reason that such hydroceles often u
cure. An acquired hydrocele is ofte
injury, to urethritis, to balanitis or t
are ignorant as to the manner in whi
lead to a collection of fluid in the tunic

Symptoms.—The symptoms are si
sented by an adult. There is a tense,
the scrotum, which is translucent. Th
congenital cases can be reduced in size
fluid it contains into the abdominal ca
generally situated behind the sac, but
it may be retained, or it may not have
bottom of the scrotum. A hernia n
hydrocele either by passing directly in
invaginating its upper wall. A hydroc
circumscribed tumour presenting the
racters as that described above; but it
actually within, the external abdomin
therefore more likely to be mistaken for

Diagnosis.—Hydroceles have to be
herniæ, from cysts of the spermatic cord
testis. The translucency of a hydrocel
tinguish it from a hernia or a retained
presence of a single cyst will distingui
the cord from a multilocular cystic tumo

Prognosis and Treatment. — The
forms of hydrocele in children is good;

cele does not disappear after a few months, it may be punctured with a very fine trocar and canula. All the fluid should be drawn off, and the puncture should be closed with a piece of absorbent wool soaked in collodion. In the congenital forms, where there is a wide aperture of communication with the peritoneum, a woollen truss (p. 413) may be worn for a few months, to prevent the formation of a hernia whilst the developmental changes are being completed.

When the hydrocele refills after puncture, it may be injected with a 1 in 5000 solution of perchloride of mercury, for the hydrocele fluid is rich in globulins, which are precipitated by the mercuric salt. I have recently been treating troublesome cases which refill in spite of tapping and injections, by laying open the scrotum and dissecting out the sac, ligaturing its neck, if necessary, with aseptic silk. The wound on every occasion has healed by first intention, and the results have appeared to be so satisfactory that I propose to continue it.

DISEASES OF THE FEMALE GENERATIVE ORGANS.

Ovarian Tumours.[63]

Varieties.—Ovarian tumours occur in quite young children, and they are occasionally congenital. They may be classified as innocent and malignant. The innocent tumours are either cystic, fibrous, or dermoid. The malignant tumours are either simple or cystic sarcomata, or, more rarely, carcinomata.

Diagnosis.—Ovarian tumours in young children may be mistaken for sarcoma of the kidney, hydatids of the liver, congenital hydronephrosis, cysts of the mesentery, or even for tuberculous peritonitis. Precocious pregnancy

should always be excluded in older c
nosis must be made by a physical exa
bimanually through the rectum and a
ing which is greatly facilitated by th
an anæsthetic. The exact seat and na
can often be cleared up only by an e
Tuberculosis of the ovaries and Fallopi
times be recognised by this method.

Treatment.—The first ovariotomy
formed by Mr. Bryant; but there are r
record. The operation for innocent tum
satisfactory results, unless the adhesions
or there are intimate attachments to
mortality after operations for malignant
that it is doubtful whether the operatio

Pyosalpinx.

A few cases are recorded in which
lopian tubes in young girls have beer
tended with pus. The condition is
with general tuberculosis, and as yet h
gical interest.

Sarcoma of the Vagin

This occurs occasionally in children
years old as a primary affection. The g
protrudes from the vulva, and readily rec

Vulvitis.

Vulvitis is more common in children
nitis, for the vagina and the glands in i
are not yet functional, and the inflamma
less likely to spread.

Ætiology.—The ordinary causes are l
conditions occurring in neglected and tub

but it is sometimes seen in connection with the exanthemata, as has been already described (p. 21).

Treatment.—The treatment consists in the removal of any causes of local irritation, such as thread-worms, and it then yields readily to the ordinary antiseptic applications, with cod-liver oil and a little grey powder in the more debilitated children. Dr. Amand Routh suggests the use of a lotion consisting of warm milk and water, to each pint of which a teaspoonful of borax and a teaspoonful of liquor plumbi subacetatis have been added. The lotion should be applied several times a day by making the child sit in a basin or bath containing it. The parts should be well dried, and a piece of lint soaked in the lotion should be kept over them.

Vulvo-vaginitis.

Vulvo-vaginitis also occurs in children, but it is usually the result of gonorrhœal infection. An epidemic of the gonorrhœal form has lately been traced to the indiscriminate use of a thermometer introduced into the vagina of several children in succession and without proper cleansing.

The **Treatment** is the same as for cases of vulvitis; but if the discharge is very irritating, Dr. Routh advises that a solution containing a scruple of nitrate of silver in each ounce of water should be painted over the inflamed area, which should then be covered with a layer of ointment made by mixing thirty minims of extract of hamamelis with an ounce of vaseline.

Adherent Labia Minora.

Children are often brought to the surgeon with a slight adhesion of the labia minora. The two labia must be separated with a probe, and a pledget of oiled lint should be kept in the vaginal orifice for twenty-four hours.

CHAPTER XXV

DISEASES OF BLOODVESSELS AND NÆVI

ANEURYSMS.[64]

Aneurysms are rarely met with in children, but traumatic and intracranial aneurysms are more frequent than the spontaneous forms. Traumatic aneurysms may occur in any part of the body, though they are most frequent at the wrist, on the dorsum of the foot, and in the posterior tibial artery. The only one which I have seen came under my care when I was acting as ophthalmic house-surgeon at St. Bartholomew's Hospital. It was intra-orbital, and resulted from a gunshot wound, in a young adult. Furious hæmorrhage from the nose took place, which was permanently controlled by ligature of the common carotid artery. Spontaneous aneurysms are either primary or secondary. The primary forms are extremely rare, and the recorded cases have been carefully tabulated by Mr. R. W. Parker in the 67th volume of the *Transactions of the Royal Medico-Chirurgical Society*, and more recently by Prof. Keen.[64] The secondary aneurysms are embolic in origin, and are usually associated with valvular disease of the heart. They are often intracranial, and may be multiple.

Treatment.—The treatment does not differ from the treatment of similar conditions in adults. The traumatic forms, if they are accessible, must be cut down upon, the

artery ligatured upon either side with aseptic silk, the sac removed, and the wound should be made to heal by first intention. The spontaneous aneurysms may first be treated by pressure, and if this fails, an interval of several days should be allowed to elapse before the artery is ligatured by the Hunterian method, but with aseptic silk.

NÆVI.[64]

Ætiology.—Nævi are usually innocent, and they are often purely local. Little or nothing is known of their cause, except that they may be hereditary, and are perhaps the result of congenital trophic neuroses. Mr. R. W. Parker believes that they are due to abnormal conditions of the capillary plexuses which surround the appendages of the skin, especially of the hair follicles, or of the vascular loops found in the papillæ of the true skin.

They occur in all parts of the body, for I have seen them in the liver and in the membranes of the brain; but only those which grow in connection with the skin and mucous membranes at the orifices of the body can be treated by surgical means.

Varieties.—Nævi are either vascular, lymphatic, or pigmented. The vascular nævi are either capillary, cavernous, or arterial—the lymphangiomata forming a separate group. The pigmented occur as hairy moles, or simply as pigmented portions of skin in connection with a system of dilated bloodvessels.

The "capillary" nævus is the most common form of vascular nævus. It is a small and bright red patch in its simplest condition, situated upon some part of the skin, or upon the mucous membranes of the inner canthus of the eye, the lip, or tongue. This form of nævus is sometimes multiple; it grows rapidly or slowly, or it may disappear

entirely during the first year of life.
per cent. of these nævi grow upon some

Treatment.—The treatment in the
sists in the application of ethylate of
Böing and Caesfield[64] have each recor
solution of corrosive sublimate collodio
is usually too strong an application fo
use a 1 in 12. It is a most effective re
surrounding the nævus must first be pr
of simple collodion, which should be allo
the sublimate collodion is applied. Two
the collodion are applied, and are left on
days, when the pellicle falls off, leavir
soon heals, or a smooth and white sca
tions are only serviceable in the very s
fuming nitric acid has generally to
ordinary capillary nævi, though such a
be made to growths near the eye. Th
nævus is protected by painting over it a
and the nævus is then brushed with f
until the epithelium is destroyed. It
layer of gauze, cemented over the sore pl
if the nævus is small, or a wet dressing
growth is so large that there is likely
charge. Capillary nævi may be very
may grow rapidly for some time, and
stationary. They sometimes form "port
pigmented nævi, which are disfiguring, b
yet amenable to any form of treatment,
may be worse than the original mark.

Subcutaneous or "venous" nævi are m
often as the capillary forms. They are sc
ated beneath the skin, and they often
nævus immediately above them. They o

of the body; they may be multiple, and they are sometimes found to develop beneath a capillary nævus. They may attain to an enormous size, when they may take the form of a general telangiectasis, and may be associated with the presence of a rete mirabile in place of some of the large venous trunks, as in the late Mr. Hulke's case. They are soft swellings which can be reduced by gentle and sustained pressure.

Pathology.—These nævi are either capillary or venous. The capillary form consists entirely of altered capillaries, which communicate freely one with another, forming large spaces. The venous form is partly produced by dilatation of the veins, and partly by dilatation of the capillaries. They undergo many secondary changes in the course of their growth, for they may become converted into fibrous tissue, they may undergo cystic and fatty change, or they even become sarcomatous. Mr. Stephen Paget has shown that some of the less well-defined forms may be cured spontaneously by a process of indolent ulceration, commencing at the centre, and spreading to the periphery. The ulceration, though usually slow and painless, sometimes runs an acute course, apparently as a result of thrombosis, and in such cases sloughing may occur.

Treatment.—There is no doubt that in a healthy child the ideal method of treatment is by cleanly dissecting the tumour away, if it is situated in any part except the face. The capsule should not be opened, for the nævus can then usually be removed without much loss of blood. This method, however, is frequently impossible, on account of the size or position of the nævus, and electrolysis then offers the best substitute for it.

The treatment of nævi by electrolysis was systematised in this country by the late Dr. Steavenson, and has been worked out by Dr. Lewis Jones. It is best fitted for the

cure of subcutaneous nævi, which can s
stroyed by this method without leaving
the marks made by the entrance of the
the great advantage over excision and
caustics, of being painless, but it has th
requiring several sittings to effect a cure

The needles employed are either single
they are of platinum, for use both at the
at the negative pole of the battery. Th
except at their points, and they must b
tissues as far as the insulated portion
is passed, so that the skin may remain u
it is essential that the scarring should
possible, the platinum needles connected
pole are put into the nævus, whilst a pa
salt solution is applied to some other par
attached to the negative pole.

A current of 10–30 milliampères is suf
nævi. It is passed for five minutes, a
the needles in the tumour is then alt
withdrawing their points, and the curr
second period of five minutes. Needle
may be passed into the tumour when
consequence, and the nævi are large. A
milliampères may be employed in such
of the needles being frequently change
the unit of current strength in the sam
inch is the unit of length. It is ro
generated by a single Daniell's (copper
volt passing through the resistance of o
column of mercury one square millimet
and 100 centimetres in length. The e
ployed in medicine is the one-thousa
ampère or a milliampère). A battery

ammoniac) cells or of Stöhrer's (bichromate) cells is generally employed to generate the electricity; whichever is used must be provided with a galvanometer graduated in milliampères, so that the surgeon may know the strength of the current he is using.

The needles having been introduced, the current is slowly raised until gas is evolved round the needles at both poles. The current must be shut off before the needles are withdrawn, and any slight bleeding which may occur from the site of the positive pole is easily arrested by the application of a pad and bandage.

No attempt should be made to do too much at a time, and the child must be anæsthetised. The object of the operation is to break up the bloodvessels, and to coagulate the blood, but not to cause necrosis or destruction of the skin. The method is a useful one, and by it a large nævus may often be converted into a mass of fibrous tissue, which can in due course be excised.

In very many cases, however, nævi are beyond the reach of surgery. They are sometimes very troublesome to treat when they occur near the inner canthus of the eye, for the scar produced in curing them may give rise to ectropion, or to stillicidium lachrymarum, from displacement of the punctum; on the other hand, if they are not completely removed, they grow again with astonishing pertinacity.

Arterio-Venous Angiomata.

These are frequently congenital, but they are sometimes only observed after an injury. They may occur at any part of the body, and sometimes involve the soft tissues, and even the bones, so extensively as to render their removal an impossibility. Thrombosis of the main veins has occurred in some of these cases, whilst others have been attended by gangrene of the soft parts.

Arterial Nævi.

Arterial nævi nearly always occur
though they have been seen upon the d
in direct connection with the dorsalis pe
may form a small pulsating swelling, co
one of the main branches of the tempor
often they are very large tumours, occu
part of one side of the skull—the true *cir*
aneurysm by anastomosis. They are occ
the orbit, in the nasal fossæ, and amongst
of the neck; but in these positions they
surgically. They should, if possible, be
turing the main trunks of the arteries; a
been done effectually, the tumour may
moved at leisure and without much loss

BLOOD TUMOURS OF THE

Ætiology.—Prof. Lannelongue[65] and
called attention to various forms of blood
the scalps of children. These tumours
the superior longitudinal sinus. They a
genital, and sometimes the result of in
matic forms appear to be due either to di
sinus, or to rupture of some of the veins
tumours are true angiomata, accompanie
of the veins connecting the intracrani
cranial circulation, and communicating
longitudinal sinus. They are often as
tarded ossification of the cranial bones.

Symptoms.—A soft, irreducible t
characters of a subcutaneous nævus si
scalp near the middle line, but differing

nævus in possessing a pedicle which passes through the sagittal suture.

Treatment.—Well-applied pressure appears to be the most satisfactory treatment in the traumatic cases, if it be commenced as soon after the accident as possible; whilst in the congenital cases nothing should be done so long as the tumour is small and stationary; but if it is increasing in size, and there appears to be a danger of its rupture, the pedicle should be ligatured and the tumour removed.

LYMPHANGIOMATA.[65]

Varieties.—Lymphangiomata exist either as dilated vessels forming a lymphangiectasis or as lymphangioma. True lymphangiomata have already been dealt with in that form which occurs as macroglossia or macrocheilia (p. 266). They are congenital tumours, formed by the distension of pre-existing lymph paths, with a general hyperplasia of the surrounding tissue. Cavernous lymphangiomata are found in various parts of the body either as small and well-defined vesicular tumours, or as diffuse growths leading to a condition of false elephantiasis. These tumours are often congenital, but they are sometimes said to bear a direct relation to injuries. Mr. Harold Stiles,[66] in a recent and interesting paper, has shown that a cavernous lymphangioma growing upon the forearm contained a considerable quantity of unstriped muscular tissue in its substance. Cavernous lymphangiomata may undergo cystic degeneration when they form cystic hygromata.

Symptoms.—The symptoms of a cavernous lymphangioma vary with the character of the growth from a small vesicular tumour filled with a clear fluid, which cannot be mistaken, through the subcutaneous form which may be looked upon as a lipoma, up to the most diffuse form which

enlarges the part affected to a condition of elephantiasis. The circumscribed form of subcutaneous lymphangioma is most often seen upon the shoulder, either in the supra-clavicular or in the supraspinous regions, and it is liable to sudden hæmorrhages into its substance.

FIG. 57.—A child, aged 14 days, with cystic lymphangioma of the left side of the face, before its removal.

Treatment.—The treatment of lymphangiomata, like that of the angiomata or nævi, consists in compression, electrolysis, excision, or, if the surgeon prefers to adopt it, the injection of iodine, carbolic acid, or dilute solutions of corrosive sublimate.

Cystic Hygroma.—These tumours form an extremely interesting group of cases. They are pathologically cystic lymphangiomata, and although they are always congenital, the child may attain to some age before they are observed. They grow from any part of the body, but they are most

Fig. 58.—The same child, aged 10 weeks, after removal of the cystic lymphangioma.

common in the neck and axilla. The tumour varies very remarkably in different cases. It is quite transparent in some, and is clearly a simple sac filled with serous fluid; whilst in others it is covered with normal opaque skin (as in fig. 57), and its fluctuation is so indistinct that it is

likely to be mistaken for a lipoma. The cysts in these more dense specimens are multiple, and vary greatly in size. Both forms have far-reaching connections, and the surgeon who lightly undertakes their removal is likely to be woefully undeceived as to the amount of dissection necessary to effect their extirpation.

Treatment. — Removal of these tumours by careful dissection is the proper treatment to be adopted, and this can usually be done without much loss of blood, for they are not very vascular.

Simple puncture is sometimes of service when the cyst is single and thin walled, but it is useless in the multilocular forms. The smallest and simplest forms occasionally disappear spontaneously. It will sometimes be found impossible to remove the whole of a large tumour at one operation; so it will be advisable to remove the deepest part first, and leave the outlying portions to be dealt with at some future time. In every case the strictest asepsis must be secured, for the wounds do not always heal kindly.

CHAPTER XXVI

BURNS AND THEIR TREATMENT

THE dangerous nature of burns and scalds in young children has long been recognised. If the unfortunate victims do not die directly of the shock, they pass through a tedious and painful period of suppuration, and the resulting scars have a constant tendency to contract, leading to revolting deformities which task to their uttermost the resources of plastic surgery.

Antiseptic surgery has shown that the stage of suppuration, if it cannot be entirely avoided, can at any rate be materially abridged. The suppuration after a burn is no more necessary than it is after any similar injury leading to the extensive disintegration of tissues. It is due to the fact that the skin always contains sufficient micro-organisms to produce suppuration when favourable conditions for their growth are present, and that these organisms are extremely difficult to destroy. They are certainly not killed at a temperature which may produce a burn. For in a child a burn of the second degree may be caused by a temperature of 104° F., whilst the tougher skin of an adult requires a temperature of 167° F. In ordinarily healthy people, vesication does not produce suppuration if the blisters are allowed to remain intact, for the epithelium then prevents infection of the injured surface; but suppuration easily occurs in the more severe forms, where the moist and absorbent surface is kept in contact with dead and dirty skin.

It is essential, therefore, to the ase burns that the injured part and its neig be thoroughly cleansed. It is a pai process, and the child should be anæstl being carried out. All shreds of the tiss have been destroyed ought to be first cut should then be lightly and thoroughly and water, and afterwards with ether. operation must be performed with the or more harm than good will be done.

The tissues which are now aseptic powdered with subnitrate of bismuth, a few layers of cyanide gauze, protected w cotton-wool, the dressing being kept in linen bandage. It is essential that tl be as light as possible, and that it shou more often than is absolutely necessar ration has occurred, the subnitrate of replaced by powdered salicylic acid, afte carefully washed away. Thiersch's me ing will greatly accelerate the process as a healthy granulating surface has be

The objection to this method, whic excellent one, is that it can only be hospital. For private practice it is cl rated solution of picric acid yields th burns. It allays pain, and prevents slighter forms, whilst it acts as a good more severe forms.

The thiol treatment, as it is used in deserving of a trial. Wash the burn solution of corrosive sublimate. Cut which have been broken, but leave unto are intact. Dust boric acid all over the

been deprived of their epidermis. Paint the burn and the surrounding skin with liquid thiol, diluted with an equal quantity of water, and then apply a pad of absorbent wool over the whole. The dressing should be renewed at the end of a week, and it is said that the wound usually heals under one or two dressings.

Mr. Staveley tells me that he has often obtained excellent results by immersing burnt children in a bath at 100° F., into which a quart of boric lotion, containing 600 grains of boric acid, has been well stirred. Any adherent clothing is allowed to soak off, and the child is then taken out, dried, and the burnt parts are dusted with powdered iodoform or with subnitrate of bismuth. Dressings of cyanide or iodoform gauze are afterwards applied, and only renewed when it is absolutely necessary to do so.

The After-Treatment of Burns.

The process of repair may often be hastened by the judicious grafting of skin in cases of extensive burns. This method is also of service, as it prevents undue contraction of the cicatrices. It should not be adopted, however, until the injured surface has become covered with healthy granulations, and every care must be taken that these granulations do not become exuberant.

Thiersch's Method of Skin-Grafting.

This method (p. 60) consists in rendering the skin and the wound aseptic. The wound must be healthy, and its base firm and in a good condition to facilitate the growth of the capillary loops into the loose tissue upon the under surface of the grafts, so that they may obtain a food-supply quickly. Very large grafts are used, and as much as possible of the wound is covered. Every care must be taken [illegible] suppuration during the grafting

The *technique* of the operation is as
cerated surface and the skin from which
be taken is rendered sterile on the day be
by the ordinary means, and is then dre
press soaked in sterilised 0·6 per cent. so
salt. The patient is anæsthetised, the
scraped away with a sharp spoon, the b
irrigated with a 0·6 per cent. salt soluti
ture of 105° F., and is firmly compresse
gauze until the bleeding has stopped.

The dressings in the meantime are r
prepared limb. In a child I usually sele
thigh; the skin is again washed with a
of carbolic acid, and is then thoroughly i
hot normal saline solution, to wash awa
the carbolic lotion. The skin is then ma
left hand, and as large sections as possi
a razor whose blade is wetted with t
solution. The sections should be as long
possible, but they should not encroach up
so that there is no immediate bleeding w
though there is a little oozing afterward
are floated off the razor on to the surf
which should now be free from blood.
arranged by means of a pair of fine-p
forceps, care being taken to get the secti
that the epidermic surface is uppermos
lightly pressed into place with a spatul
any blood which there may be under it
into intimate connection with the subjacen
all the grafts have been put in place,
wound are oiled with sterilised oil, to pr
sticking, and the wound is dressed with
to which no antiseptic has been added.

The gauze should be moistened with normal saline solution for a week; but after that time dry dressings may be applied, and a little powdered nitrate of bismuth may be dusted over the wound. The dressings should be changed daily, but with the utmost care not to disturb the grafts, which should be gently irrigated upon each occasion with a little warm salt solution. The limb from which the graft was taken must be dressed antiseptically, and it may be left untouched until it has healed, for this usually takes place without any hitch. It is many months, however, before the grafts form an integral part of the surface to which they have been transplanted, and during the whole of this time they must be protected from injury. The operation is successful if the grafts are pink at the end of a few days; but if they are white, they are going to die. Considerable experience has taught me that much of the success of the operation consists in having the salt solution sterile and in avoiding as far as possible the use of antiseptic applications.

Plastic Operations.

It often happens that a child is not brought to a surgeon for advice until severe scarring has produced great and permanent deformity, for the relief of which a plastic operation is alone of service, though shampooing will often prove beneficial in the slighter cases. The treatment of severe cicatricial deformities after burns is always a subject of deep interest to surgeons, for it is as a rule most unsatisfactory. Mr. Croft has recently suggested a modification of the plastic operation from which he claims to have obtained excellent results. His method consists in raising a bridge of skin whose length is about three times greater than its width. The bridge is cut as thick as possible, and as near to the centre as

can be managed without actually cutting into the scar tissue. It is left attached at either end, but it is raised along its whole extent so as to allow the edges of the wound to be sutured together. When this has been done, a piece of oiled silk protective is inserted between the under surface of the bridge and the line of incision, to prevent adhesions being formed between the two.

The second part of the operation is performed a fortnight or three weeks later. It consists in dividing the contracted scar, cutting one end of the bridge loose and transplanting the flap in such a way that the bed and the strip of skin agree as far as possible in shape and extent. The under surface of the strip usually requires a little paring or freshening, in order to secure union by first intention.

Mr. Croft thinks that it is sufficient to obtain primary union between the free end of the strip and the fresh wound; for if this can be ensured, the rest will follow in due course. For scars in the neck the skin was taken from the back of the neck and from the shoulder, and the strips were sufficiently long to cross the median line.

CHAPTER XXVII

SOME MALFORMATIONS AND CONGENITAL DEFORMITIES

SPINA BIFIDA.[67]

Varieties.—Spina bifida is either a meningocele or simple protrusion of the membranes covering the spinal cord; or it is a meningo-myelocele when the protrusion contains some of the essential constituents of the spinal cord; or it is a syringo-myelocele when the walls of the cyst are composed of the spinal cord itself. The sac in each case contains cerebro-spinal fluid to a greater or less extent. The meningo-myelocele is the commonest form: syringo-myelocele occurs occasionally; simple meningocele is very rare.

Ætiology.—The condition is always congenital, and its cause has given rise to many theories. It has been supposed that a hernia of the spinal membranes has interfered with the developmental changes, leading to closure of the vertebral arches. If this has taken place early in embryonic life, the skin may have been replaced by a thin membrane; but if the hernia has occurred late, the skin may be normal. The skin over the tumour is sometimes so completely replaced by scar tissue that it appears as if some forms of spina bifida were caused by local inflammations and adhesions of the fœtal membranes, leading to modifications of the developmental processes. Many

pathologists of great repute maintain t
the protrusion is permitted by a defect
vertebral arches, due to errors in the d
mesoblast from which are derived the s
the roof of the vertebral canal. In a fe
tive closure of the vertebral laminæ ar
the presence of congenital tumours in th
such as exostoses, chondromata, lipoma
teratomata.

Morbid Anatomy.—The swelling i
the lumbo-sacral region of the cord, n
region, and afterwards in the dorsal, lu
regions. The sac of a meningocele is d
arachnoid, and the fissure is usually stri
line. It is quite translucent to transm
generally placed higher in the vertebral
other varieties. The defective closure
portion of the vertebral column is limi
diate seat of the tumour.

Meningo-myelocele represents a partia
central canal. The defects in the skin
are often very marked, and there may
portion. When it is seen by transm
marking the position of the nerve-roots a
visible within the sac. Large tracts, or
the vertebral column, may be imperfec
meningo-myelocele is often associated wit
defects, such as club-foot, and more rarel

The tumour, in cases of syringo-my
smaller than in meningo-myelocele, the
the tumour is always placed laterally, a
ated with faulty development and asym
tebræ. It is lined with a layer of cylind

Spina bifida occulta occurs when there i

of the posterior parts of the vertebræ, without any well-marked protrusion of the spinal membranes. It may be associated with hypertrichosis of the affected part, some anæsthesia, and even with perforating ulcers. It presents a doughy swelling, in which deep pressure reveals a separation of the vertebral laminæ.

Diagnosis.—A spina bifida must be distinguished from sacro-coccygeal cysts, from lymphangiomata, from hard or soft fibromata, from dermoids, and from teratomata. Pigmented hairy moles in the middle line of the vertebral column should always be carefully examined to ascertain whether they have a spina bifida occulta underlying them.

Some forms of spina bifida are anterior instead of posterior, and in some instances their presence is marked by a cystic tumour overlying them.

Prognosis.—The prognosis in syringo-myelia and in meningocele is good, but in meningo-myelocele it is doubtful. The tumour in many cases of meningo-myelocele is large, its skin is damaged, and many of the posterior arches are defective. Inflammation and suppuration are therefore very likely to occur.

Symptoms.—The symptoms are easily deduced from the morbid anatomy and the pathology of the condition. There is a rounded or oval swelling, which is [illegible] and fluctuating. The size of the [illegible] in many cases by pressure; but [illegible] with care, for it is painful, and it [illegible] the limbs, convulsions, or even [illegible] spina bifida in infants may produce [illegible] the tension of the anterior [illegible] the cord may lead to certain [illegible] interest, for there may be [illegible] or even hyperæsthesia [illegible] urine, fæces and other [illegible]

Treatment.—Syringo-myelocele does not as a rule require any treatment.

A meningocele should be protected from pressure or from any influence likely to produce inflammation of the sac. It sometimes undergoes retrogressive changes, which lead to its cure. When it is situated high up in the cervical region, when it is an eyesore, or when from its liability to injury there is a danger of its causing spinal meningitis, it may be removed aseptically. The sac and its pedicle are exposed by a vertical incision, and the pedicle is compressed to prevent blood flowing into the vertebral canal. The sac is then removed, its edges are accurately united with aseptic silk sutures, the pressure forceps are removed from the pedicle, and the skin is brought into such accurate apposition that union occurs by first intention. The double row of sutures appear to be necessary, because in some of the recorded cases there has been an uncontrollable flow of cerebro-spinal fluid after this operation, which has led to a fatal termination.

The treatment of meningo-myelocele varies with each individual case.

(1) *Palliative.*—If the tumour is small and the skin is fairly normal, I content myself with ordering a hollow indiarubber or leather cup for the child. The edge of the cup should consist of an indiarubber lip containing air, like that forming the edge of the face-piece of a Clover's ether-inhaler. Care must be taken that the cup is larger than the tumour, so that its edges may press upon the healthy skin of the back. The use of such an apparatus is purely protective, and in no way curative.

(2) *By Injection.*—When the skin is very unhealthy, and when the swelling is so tense that it seems likely to yield, the tumour must be tapped. This is done with a sterilized trocar and canula, with the child lying upon its

side. The trocar should be entered obliquely through the healthy skin at one side of the base of the tumour. The fluid contents of the sac are allowed to escape, and a drachm of Morton's fluid is injected from a small glass syringe connected with the end of the canula by a piece of indiarubber tubing. Morton's fluid consists of ten grains of iodine, with thirty grains of iodide of potassium dissolved in an ounce of glycerine. The fluid is allowed to remain in the sac, the canula is withdrawn, and the puncture is sealed with a fragment of absorbent cotton wool soaked in collodion. A pad of Gamgee's tissue is then put on, and is kept in place by a lightly applied bandage. The child is laid upon its side for a few hours. The injection usually has to be repeated at intervals of a week or ten days.

The committee appointed by the Clinical Society[67] to report on spina bifida came to the conclusion that marasmus, hydrocephalus, and intercurrent disease contra-indicate the operation, and that the best results are to be hoped for in children who have reached the age of two months, in whom there is no paralysis or hydrocephalus, and when the sac is covered by healthy skin. The committee also thought that the operation was legitimate, though it was performed under unfavourable circumstances, when there is distinct evidence of the cord being in the sac, as shown by its umbilication or by a longitudinal furrow; when there is a very thin membranous or ulcerated sac; when there has been previous rupture of the sac; when there is a distinct impulse between the tumour and the anterior fontanelle; when the contents of the sac are easily returned into the spinal canal, and when the patient is very young.

(3) *Radical.*—Excision of the sac of a meningo-myelocele is hardly a justifiable operation under ordinary conditions;[67]

but in older patients whose physical co
it may be worth while to remove the sa
time endeavour to close the defect in th
by means of an osteoplastic operation
transplantation of longitudinal strips
from each side of the rudimentary lamin

DERMOIDS AND CONGENITA

Pathology.—Dermoids and congenit
great interest to the children's surgeon
with them clinically, as to the patholo
siders them for their own sakes. The
developmental errors, and are most fr
those points in the body where layer
coalesced. Mr. Bland Sutton, who has
very carefully, shows that the areas wh
frequent can be divided into the prin
as the dorsal line produced by the fusio
folds, or along the ventral line resultin
of the abdominal walls. The secondary
produced by the fusion of more highly
such as the lines of closure of the man
palatine and genital clefts. Dermoids a
connection with the secondary than
lines of union. The origin of the dermo
cysts growing in the floor of the mout
has lately received special attention.
lateral or they are median. Some of th
and the majority of those situated later
in origin. Many of the median tumo
those which appear to be lateral, are
thyreo-glossal duct or from the sinus p
thyreo-glossal duct runs from the thy

the hyoid bone to the foramen cæcum in the tongue. It commences as a bifurcated tube, which unites below or behind the hyoid, and is continued upwards as the lingual duct. It is lined with columnar ciliated epithelium, except at its upper part, where the cells are squamous. The duct ought to be obliterated completely, but it may remain patent, either wholly or in part. Dr. Herbert E. Durham has lately examined the pathology of the congenital tumours formed in connection with the thyreoglossal duct in a very able and lucid manner, and his results are published in the 77th volume of the *Transactions of the Royal Medical and Chirurgical Society.*

Congenital cysts may also be found in an unobliterated sinus præcervicalis situated in the position of the third and fourth branchial arches. They may be placed laterally when they are developed in connection with a branchial cleft, or they may have been median originally, becoming displaced to one or other side by pressure of the muscles. They are either thin-walled with serous contents, or thicker-walled with a more mucoid substance. Their walls are composed of connective tissue lined with cylindrical ciliated cells, and in this manner they may be distinguished from the lymphatic nævi which have an endothelial lining.

Dermoids are cysts containing sebaceous material alone, or sebaceous material with hair. Their walls consist of skin, with sweat and sebaceous glands, and hair follicles may also be present.

Diagnosis.—Dermoids and congenital cysts are very liable to be mistaken for sebaceous cysts, for abscesses, for spina bifida, for meningocele, for encephalocele, and for a ranula if the tumour is on the floor of the mouth.

Treatment.—Dermoids, when they are small, when they are not unsightly, and when they show no tendency

to inflame, had better be left alone. Th
and the surgeon must then remove th
enucleate them without rupture of the
pared for a much more extensive operat
ficial appearance of the tumour would
The wound often heals badly, in spite o

The smaller congenital cysts may b
larger ones generally refill; so that it
them bodily if it is necessary to perf
upon them. Cysts which are presuma
nection with the thyreo-glossal duct s
very extensive operation for their extir
bone may require division and subseque
stinate fistulæ are often left, unless the
be extirpated.

SACRO-COCCYGEAL C

Ætiology.—The sacro-coccygeal tun
plex but by no means a frequent class o

Pathology.—They are divided into
which the most interesting are the ter
most highly developed form, these tu
fœtuses, though in some cases they a
highly organised tissues possessing a ruc
whilst others again approach more nea
rhabdomyomata.

The cystic tumours are either simpl
latter being innocent or malignant.
importance, for they are likely to be
bifida, though they occur in the coccyg
spina bifida is rarely, if ever, seen. T
cystic tumours grow from the anteri
coccyx, and only project backwards as

of their growth. They appear to be remnants of that development in the coccygeal region which, attaining its maximum during the fifth month of intra-uterine life, begins to atrophy during the sixth month, and should have disappeared at birth. The cysts are sometimes replaced by the primitive series of canals lined with cylindrical epithelium embedded in connective tissue containing cartilage and bone.

The various forms of fibro-lipomata, or even gliomata, are, from a structural point of view, the simplest group of sacro-coccygeal tumours. They may be extremely vascular, and, like the cystic tumours, they usually grow from the connective tissue lying between the rectum and the coccyx.

Symptoms.—The symptoms vary greatly with the nature of the tumour. The most highly developed form, the included fœtus, may possess the power of reflex excitability, whilst the more lowly organised teratomata hardly differ from the solid tumours. The cystic forms may be intrapelvic or extrapelvic. An interesting example of the intrapelvic form came under my care last year in a girl aged two months, who suffered from retention of urine caused by its pressure upon the ureters. A bimanual examination through the rectum and the abdomen revealed a tense and elastic swelling upon the right side, extending from the pubes to the umbilicus. The swelling was fixed, it was pyriform in shape, the upper broad end being rounded and sharply defined. I performed a median laparotomy, but found that the tumour was too deeply seated and too firmly fixed to allow of its removal. The child died with diarrhœa two days after the operation. The bladder was found at the post-mortem examination to be much thickened, the ureters were dilated, and the kidneys were in a condition of hydronephrosis. The

uterus, ovaries, and Fallopian tubes w
rectum for an inch above the anus was
immediately above this point a large o
jected into its lumen without causing
This swelling, as is seen in fig. 59, was
which sprang from the right side of
was apparently in intimate connection

FIG. 59.—Pelvic organs, showing a congenital cyst
part of the rectum. *R*, The rectum laid open lateral
of the cyst into its interior; *C*, the cyst, showing
tapered into a fine cord *G*, which was lost in the con
rectum; *U*, the uterus with the two ovaries hanging
B, the thickened bladder.

[*From the "Transactions of the Pathological S*

lines of the cyst were smooth and uni
lower part, where it suddenly tapered
delicate cord, consisting only of the li
the cyst. This cord soon lost itself in
tive tissue lying between the lower

and the coccyx. The cyst contained a mucous fluid, and was lined with cylindrical and ciliated epithelium.

The extrapelvic cysts and tumours are usually irregular in outline, and they vary in consistence at different parts. There is often no doubt as to their origin from the front of the coccyx, for the space between the anus and the coccyx may be so much increased as very greatly to reduce the width of the perineum. In some cases, however, the tumours pass along the side of the coccyx, and their exact origin is then more difficult to determine.

Treatment.—The treatment of an included fœtus consists in removal of the projecting part and suture of the skin over the stump. The intrapelvic tumours sometimes remain unrecognised for many years, until, by projecting into the rectum, they may give rise to symptoms, or they may themselves suppurate. The extrapelvic forms may be excised if the surgeon can assure himself that they are not in direct connection with the vertebral canal.

The simple cystic tumours may be treated by aseptic tapping; but the more complex varieties must be removed completely if the surgeon feels satisfied that this can be done; otherwise they had better be left alone. He should always remember, however, that their attachments extend much more deeply than their superficial appearances indicate.

CONGENITAL HYDROCELE OF THE NECK

Children are sometimes born with very large hydroceles of the neck, which appear to be developed in connection with the branchial arches, and are to be distinguished from the cystic lymphangiomata described at p. 497.

CONGENITAL UMBILICAL POLYPUS.

Mucous polypi, developed, Mr. Pearce Gould supposes, from the remains of the umbilical vesicle, are occasionally seen springing from the navel either at birth, or after the umbilical cord has dropped off. The treatment consists in ligaturing the pedicle and snipping off the growth. The polypus consisted, in Mr. Gould's case, of branched mucous glands lined with columnar epithelial cells embedded in a very vascular stroma of connective tissue. A fæcal fistula may be produced at the umbilicus from persistence of the ductus vitello-intestinalis, or from its imperfect obliteration a sac with muscular walls and attached to the small intestine may be present at the umbilicus, as Mr. Heaton has shown.

Abnormalities of the Urachus. — **Ætiology.** — The urachus ought to be obliterated soon after birth, but it may remain pervious either in part or throughout its whole extent. Cysts sometimes form in a partially patent urachus, and when it is wholly unclosed there may be a true vesico-umbilical fistula through which the urine is discharged. I have known such a condition develop in a child whose micturition was impeded by a sarcoma growing in its bladder.

PNEUMATOCELE CRANII.

A remarkable form of tumour is occasionally met with in children. It is situated upon the skull, and is tense, well defined, and painless. Its size can be reduced by pressure. It is often congenital, but it occasionally appears suddenly, and without any cause. It is generally situated over the temporal bone, but its method of formation is quite unknown. Puncture of the tumour through the pericranium allows air to escape, but it soon refills;

and as its size can be increased by strong expiratory efforts, there is no doubt that it has a direct connection with the respiratory passages, probably through the ear.

Treatment.—Firm pressure may be tried, but it is generally useless. Wernher gives an account of one case which was completely cured after the fourth injection of tincture of iodine. Sonnenberg maintains that these tumours are best treated by incision, to allow them to heal by granulation.

GIANT GROWTH.

Curious cases of giant growth are sometimes brought for advice. The condition is congenital, and usually affects the hands and feet. The extremities are sometimes normal, but they appear to belong to a giant. It was doubtless the occurrence of such cases that led Pliny to report, "Eosdemque Sciopodas vocari, quod in majori aestu humi jacentes resupini, umbra se pedum protegant," which Philemon Holland translates, "The same men are also called Sciopodes, for that in the hotest season of the summer they lie along on their back and defend themselves with their feet against the sunnes heat." A comparison of fig. 60 with that given in the sixteenth century English Manuscript of *Sir John Maundeville's Voiage and Travaile*, in the Library of the British Museum (8 Harl., 3954, fol. 31), will show how close is the resemblance between what the old traveller described from tradition and what sometimes actually exists in nature.

Many cases of giant growth present evidence of trophic disturbances in the form of impaired sensibility, or in peculiarities of pigmentation. The condition may therefore be due to neurotic causes affecting the tissues, as is held by Widenmann, or it may be produced by a persistent vaso-motor disturbance, as is maintained

and Monod. Both explanations, howev
factory, and are merely a cloak to our igno

The patient from whom the annexed
60) was taken has been under my care
few months old. The disproportion betw
the rest of her body becomes less as she g
overgrowth is symmetrical, and affects t

FIG. 60.—Congenital overgrowth of the feet in a chil
secondary hypertrophy of the legs.

foot, the heel and the os calcis not being i
same extent. The hypertrophy of the leg
the weight of the feet, for the patient is
walk about, and it did not exist when sh
So far as I have been able to ascertain,
feet are, and always have been, affected to
as the soft tissues.

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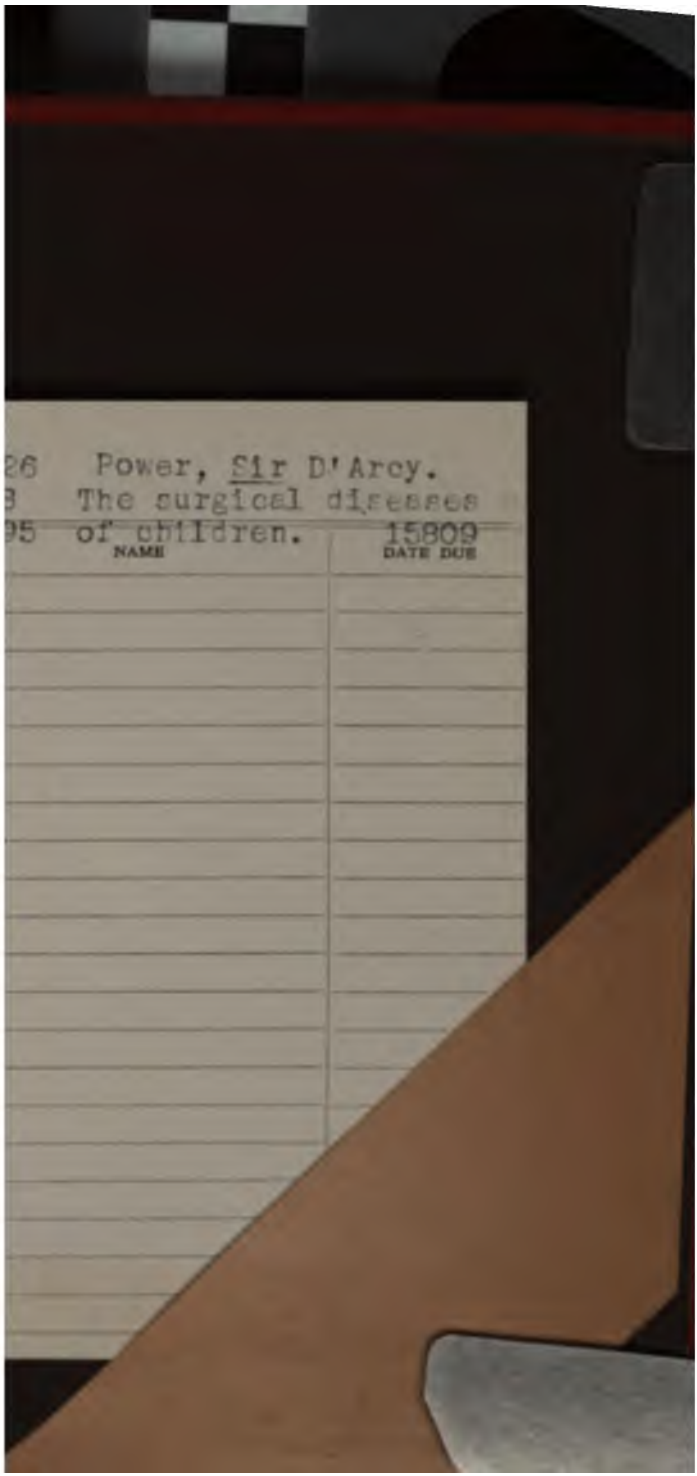
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